Special Flood Hazard Evaluation Report

Chagrin River
Geauga County (unincorporated areas), Ohio

Prepared for the
Ohio Department of Natural Resources

US Army Corps of Engineers
Buffalo District

November 1992

UNCLASSIFIED

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Chagrin River

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This technical report documents the result of an investigation to determine the potential flood situation along Chagrin River, within the unincorporated areas of Geauga County, Ohio. The study reach includes the Chagrin River from 100 feet north of Fairmount Road, upstream to Sperry Road. This report identifies the 100-year and 500-year flood plains and 100-year floodway for the Chagrin River within Geauga County.

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UNCLASSIFIED

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SPECIAL FLOOD HAZARD EVALUATION REPORT
CHAGRIN RIVER
GEAUGA COUNTY, OHIO
(UNINCORPORATED AREAS)

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SPECIAL FLOOD HAZARD EVALUATION REPORT
CHAGRIN RIVER
GEAUGA COUNTY, OHIO
(UNINCORPORATED AREAS)

INTRODUCTION

This Special Flood Hazard Evaluation Report documents the results of an investigation to determine the potential flood situation along the Chagrin River within the unincorporated areas of Geauga County, Ohio. This study was conducted at the request of the Ohio Department of Natural Resources under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reach includes the Chagrin River from 1000 feet north of Fairmount Road, upstream to Sperry Road.

The county of Geauga is located in northeastern Ohio. It is bordered by Ashtabula and Trumbull Counties on the east; Portage County on the south; Cuyahoga County on the west; and Lake County to the north. The county has an area of approximately 412 square miles and a population of 81,129 according to the 1990 census (Reference 1).

The climate of Geauga County is classified as humid continental with short periods of extreme cold and heat. The temperatures range from a high of 102 degrees Fahrenheit (F) in July to a low of -23 degrees (F) in January. The average annual high temperature is 71.2 degrees (F) and the average low is 25.7 degrees (F). The average annual precipitation is approximately 40.88 inches and average annual snowfall measures 60.9 inches (Reference 2).

The Chagrin River drains an area of about 268 square miles in northeastern Ohio. The river rises just west of the village of Chardon, near elevation 1,340, and flows in a southwesterly direction to the confluence with the Aurora Branch, south of Chagrin Falls. It then flows generally north about 27 miles to Lake Erie. Within the study area, the river basin consists of rolling hills separated by deep valleys.

Knowledge of potential floods and flood hazards is important in land use planning. This report identifies the 100-year and 500-year flood plains and 100-year floodway for the Chagrin River within Geauga County.

Information developed for this study will be used by local officials to manage future flood plain development. While the report does not provide solutions to flood problems, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development, thereby preventing intensification of the flood loss problem. It will also aid in the development of other flood damage reduction techniques to modify flooding and reduce flood damages which might be embodied in an overall Flood Plain Management (FPM) program. Other types of studies, such as those of environmental attributes and the current and future land

GEAUGA COUNTY, OHIO

VICINITY MAP

use roles of the flood plain as part of its surroundings, would also profit from this information.

Although Flood Insurance Rate Maps (Reference 3) have been developed for the community, detailed analyses was not used to study the stream reaches analyzed in this study because the area was thought to have a low development potential at the time the maps were prepared. However, the area is now experiencing residential development pressure, and local officials requested detailed flood plain information to manage development.

Additional copies of this report can be obtained from the Ohio Department of Natural Resources until its supply is exhausted, and the National Technical Information Service of the U.S. Department of Commerce, Springfield, Virginia 22161, at the cost of reproducing the report. The Buffalo District Corps of Engineers will provide technical assistance and guidance to planning agencies in the interpretation and use of the hydrologic data obtained for this study.

PRINCIPAL FLOOD PROBLEMS

Floods on the Chagrin River generally occur in late winter and early spring resulting from moderately intense rainfall along with snowmelt. Principal flood problems occur where development has been built along low river banks or in areas inside the river bends.

Flood Magnitudes and Their Frequencies

Floods are classified on the basis of their frequency or recurrence interval. A 100-year flood is an event with a magnitude that can be expected to be equaled or exceeded once on the average during any 100-year period. It has a 1.0 percent chance of occurring in any given year. It is important to note that, while on a long-term basis the exceedence averages out to once per 100 years, floods of this magnitude can occur in any given year or even in consecutive years and within any given time interval. For example, there is a greater than 50 percent probability that a 100-year event will occur during a 70-year lifetime. Additionally, a house which is built within the 100-year flood level has about a one-in-four chance of being flooded in a 30-year mortgage life.

Hazards and Damages of Large Floods

The extent of damage caused by any flood depends on the topography of the flooded area, the depth and duration of flooding, the velocity of flow, the rate of rise in water surface elevation, and development of the flood plain. Deep water flowing at a high velocity and carrying floating debris would create conditions hazardous to persons and vehicles which attempt to cross the flood plain. Generally, water 3 or more feet deep which flows at a velocity of 3 or more feet per second could easily sweep an adult off his feet and create definite danger of

injury or drowning. As indicated in Table 2, flow velocities of the stream studied exceed 3 feet per second. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed or in vehicles that are ultimately submerged or floated. Since water lines can be ruptured by deposits of debris and by the force of flood waters, there is the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters and could create health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

HYDROLOGIC ANALYSES

Hydrologic analyses were carried out to determine the peak discharge-frequency relationships for each flooding source affecting the community.

For this study, the Chagrin River was divided into two hydrologic reaches, and discharges were calculated at the downstream point of each reach. Reach 1 extends from Fairmount Road (1,000 feet downstream of the study limit) to just downstream of the fourth tributary from Fairmount Road. Reach 2 extends from just upstream of the fourth tributary, upstream to Sperry Road.

The method used to determine the 100-year and 500-year discharges is described in Water Resources Investigation Report 89-4126 (Reference 4). The equation considers contributing drainage area, slope, and storage area for each reach. Watershed characteristics were determined through the use of USGS 7.5-minute topographic maps (Reference 5) and the guidelines in the National Handbook of Recommended Methods for Water Data Acquisition (Reference 6). The values for the drainage areas and 100-year and 500-year peak discharges are shown in Table 1.

Table 1 - Summary of Discharges

Location	Drainage Area (sq. mi.)	Peak Discharges (cfs) 100-Yr	500-Yr
Chagrin River at Fairmount Road	37.2	3410	4750
just upstream of fourth tributary from Fairmount Road	32.9	3190	4300

HYDRAULIC ANALYSES

Analyses of the hydraulic characteristics of flooding from source studied were carried out to provide estimates of the elevations of floods for the 100-year and 500-year recurrence intervals.

Cross-section data for the backwater analyses of the Chagrin River were obtained from field surveys performed by Buffalo District personnel in November 1991 and April 1992. Additional data were obtained from topographic maps (Reference 7). All bridges and culverts were surveyed to determine elevation data and structural geometry. Spot elevations were obtained in the overbank areas in order to accurately delineate the flood plain boundaries.

Water surface elevations of the 100-year and 500-year recurrence interval were computed using the COE HEC-2 step-backwater computer program (Reference 8). The water surface elevation for the Chagrin River was started at normal depth taken from Section "J" (located 2,000 feet downstream of the study area) in the Flood Insurance Study Report for Geauga County (Reference 9).

Locations of the selected cross-sections used in the hydraulic analyses are shown on the Flood Profile (Plate 1) and on the Flooded Area Maps (Sheets 1 through 5).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were selected using engineering judgement and were based on field observations of the stream and flood plain areas. The values for Mannings "n" ranged from 0.03 to 0.04 in the channel and 0.05 to 0.06 in the overbank areas. The contraction and expansion coefficients ranged from 0.2 to 0.3 and 0.4 to 0.5, respectively.

Flood profiles were drawn showing the computed water surface elevations for the selected recurrence intervals. The flood plain boundaries were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using Geauga County topographic maps (Reference 7) and spot elevations obtained during the field surveys. Small areas within the flood plain boundaries may be above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

Floodways were determined for the streams studied in detail. Floodway encroachments were based on equal conveyance reduction from each side of the flood plain. At the request of the Ohio Department of Natural Resources, the maximum increase in stage due to encroachment was limited to 1 foot provided that hazardous velocities were not produced. Floodway widths were computed at cross sections and varied from 62 to 320 feet on the Chagrin River. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2. The computed floodways are also shown on the Flooded Area Maps, Sheets 1 through 5. In cases where the floodway and the 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
A	22,000	221	1034	3.3	1033.0	1033.0	1033.6	0.6
B	23,700	76	651	5.2	1034.9	1034.9	1035.8	0.9
C	26,160	90	674	5.1	1037.7	1037.7	1038.5	0.8
D	27,530	62	401	8.5	1039.9	1039.9	1040.6	0.7
E	28,930	320	935	3.6	1043.0	1043.0	1043.6	0.6
F	32,700	123	690	4.6	1055.6	1055.6	1056.0	0.4
G	34,450	224	1214	2.6	1057.2	1057.2	1058.0	0.8
H	39,270	300	1177	2.7	1063.8	1063.8	1064.5	0.7
I	40,850	200	516	6.2	1066.4	1066.4	1066.4	0.0

1 Distance is measured in feet from 2400 feet downstream of Kinsman Road.

TABLE 2

GEAUGA COUNTY, OHIO

FLOODWAY DATA

CHAGRIN RIVER

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profile are considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Descriptions of the marks are presented in Table 3.

Table 3 - Elevation Reference Marks

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	1168.274	U.S.G.S. disk located on Fairmount Road, 98 feet east of Watt Road, and 24 feet north and 3 feet higher than center of intersection. Disk is 2 feet north and 1 foot west of corner fence post.
RM 2	1131.72	Chiseled "X" on east end of headwall located on south side of Fairmount Road opposite residence #9482.
RM 3	1070.76	Chiseled "+" on top of 9-foot diameter corrugated metal culvert on south side of Fairmount Road across from residence #9614. Chisel mark is approximately 3 feet from south end of culvert.
RM 4	1076.50	Chiseled square on upstream left abutment of Sperry Road bridge over Chagrin River.
RM 5	1147.06	Top of letter "M" of monument box at intersection of Fairmount Road and Northwood Road.
RM 6	1068.39	PK nail at base of power pole (#562591) located on south side of Fairmount Road, just east of residence #8723 in vicinity of power transmission line.
RM 7	1029.48	Railroad spike at base of power pole (Mid-Continental #1401-008) located on north side of Fairmount Road, just west of bridge over Chagrin River.

Different tools may be more suitable for developed or underdeveloped flood plains or for urban or rural areas. The information contained in this report is particularly useful for the preparation of flood plain regulations.

a. Flood Plain Regulations.

Flood plain regulations apply to the full range of ordinances and other means designed to control land use and construction within floodprone areas. The term encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment line statutes, open area regulations, and other similar methods of management which affect the use and development of floodprone areas.

Flood plain land use management does not prohibit use of floodprone areas; to the contrary, flood plain land use management seeks the best use of flood plain lands. The flooded area map and the water surface profile contained in this report can be used to guide development in the flood plain. The elevations shown on the profile should be used to determine flood heights because they are more accurate than the outlines of flooded areas. It is recommended that development in areas susceptible to frequent flooding adhere to the principles expressed in Executive Order 11988 - Flood Plain Management, whose objective is to ". . . avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of flood plains . . . whenever there is a practicable alternative." Accordingly, development in areas susceptible to frequent flooding should consist of construction which has a low damage potential such as parking areas and golf courses. High value construction such as buildings, should be located outside the flood plain to the fullest extent possible. In instances where no practicable alternative exists, the land should be elevated to minimize damages. If it is uneconomical to elevate the land in these areas, means of floodproofing the structure should be given careful consideration.

b. Development Zones.

A flood plain consists of two zones. The first zone is the designated "floodway" or that cross sectional area required for carrying or discharging the anticipated flood waters with a maximum 1-foot increase in flood level (Ohio Department of Natural Resources standard). Velocities are the greatest and most damaging in the floodway. Regulations essentially maintain the flow-conveying capability of the floodway to minimize inundation of additional adjacent areas. Uses which are acceptable for floodways include parks, parking areas, open spaces, etc.

The second zone of the flood plain is termed the "floodway fringe" or restrictive zone, in which inundation might occur but where depths and velocities are generally low. Although not recommended if practicable alternatives exist, such areas can be

developed provided structures are placed high enough or floodproofed to be reasonably free from flood damage during the 100-year flood. Typical relationships between the floodway and floodway fringe are shown in Figure 2. The floodway for the Chagrin River has been plotted on the Flooded Area Maps, Sheets 1 through 5.

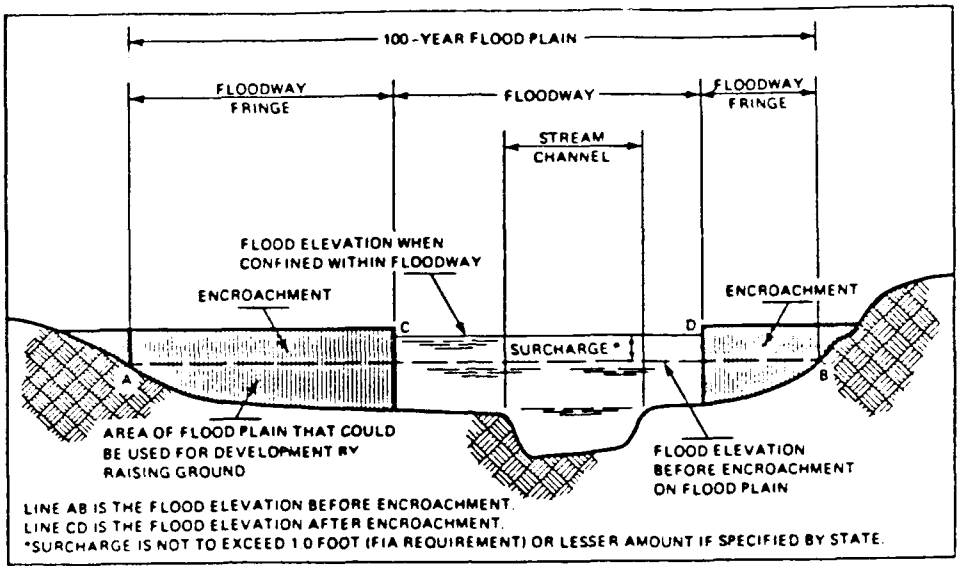


Figure 2 - Floodway Schematic

c. Formulation of Flood Plain Regulations.

Formulation of flood plain regulations in a simplified sense involves selecting the type and degree of control to be exercised for each specific flood plain. In principle, the form of the regulations is not as important as a maintained adequacy of control. The degree of control normally varies with the flood hazard as measured by depth of inundation, velocity of flow, frequency of flooding, and the need for available land. Considerable planning and research is required for the proper formulation of flood plain regulations. Formulation of flood plain regulations may require a lengthy period of time during which development is likely to occur. In such cases, temporary regulations should be adopted and amended later as necessary.

Modify Flooding

The traditional strategy of modifying floods through the construction of dams, dikes, levees and floodwalls, channel alterations, high flow diversions and spillways, and land treatment measures has repeatedly demonstrated its effectiveness for protecting property and saving lives, and it will continue to be a strategy of flood plain management. However, in the future, reliance solely upon a flood modification strategy is neither possible nor desirable. Although the large capital investment required by flood modifying tools has been provided largely by

the Federal Government, sufficient funds from Federal sources have not been and are not likely to be available to meet all situations for which flood modifying measures would be both effective and economically feasible. Another consideration is that the cost of maintaining and operating flood control structures falls upon local governments.

Flood modifications acting alone leave a residual flood loss potential and can encourage an unwarranted sense of security leading to inappropriate use of lands in the areas that are directly protected or in adjacent areas. For this reason, measures to modify possible floods should usually be accompanied by measures to modify the susceptibility to flood damage, particularly by land use regulations.

Modify the Impact of Flooding on Individuals and the Community

A third strategy for mitigating flood losses consists of actions designed to assist individuals and communities in their preparatory, survival, and recovery responses to floods. Tools include information dissemination and education, arrangements for spreading the costs of the loss over time, purposeful transfer of some of the individual's loss to the community by reducing taxes in flood prone areas, and the purchase of Federally subsidized flood insurance.

The distinction between a reasonable and unreasonable transfer of costs from the individual to the community can also be regulated and is a key to effective flood plain management.

CONCLUSION

This report presents local flood hazard information for the Chagrin River in Geauga County, Ohio. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated with the Ohio Department of Natural Resources.

GLOSSARY

BACKWATER EFFECT	The resulting rise in water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.
BASE FLOOD	A flood which has an average return interval in the order of once in 100 years, although the flood may occur in any year. It is based on statistical analysis of streamflow records available for the watershed and analysis of rainfall and runoff characteristics in the general region of the watershed. It is commonly referred to as the "100-year flood."
DISCHARGE	The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).
FLOOD	An overflow of lands not normally covered by water. Floods have two essential characteristics: the inundation of land is temporary and the lands are adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water. Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, and rise of groundwater coincident with increased streamflow.
FLOOD CREST	The maximum stage or elevation reached by floodwaters at a given location.
FLOOD FREQUENCY	A statistical expression of the percent chance of exceeding a discharge of a given magnitude in any given year. For example, a 100-year flood has a magnitude expected to be exceeded on the average of once every hundred years. Such a flood has a 1 percent chance of being exceeded in any given year. Often used interchangeably with RECURRENCE INTERVAL.

FLOOD PLAIN	The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.
FLOOD PROFILE	A graph showing the relationship of water surface elevation to location; the latter generally expressed as distance upstream from a known point along the approximate centerline of a stream of water that flows in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.
FLOOD STAGE	The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.
FLOODWAY	The channel of a watercourse and those portions of the adjoining flood plain required to provide for the passage of the selected flood (normally the 100-year flood) with an insignificant increase in the flood levels above that of natural conditions. As used in the National Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (1 foot in most areas).
RECURRENCE INTERVAL	A statistical expression of the average time between floods exceeding a given magnitude (see FLOOD FREQUENCY).

REFERENCES

1. U.S. Department of Commerce, Bureau of the Census, 1990 Census of the Population and Housing, Washington, D.C.

2. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climates of the States, 1974.

3. Federal Emergency Management Agency, Flood Insurance Rate Map, Geauga County, Ohio (unincorporated areas), November 4, 1988.

4. U. S. Geological Survey, Water Resources Investigation Report 89-4126, Techniques for Estimating Flood-Peak Discharges of Rural, Unregulated Streams in Ohio, March 1990.

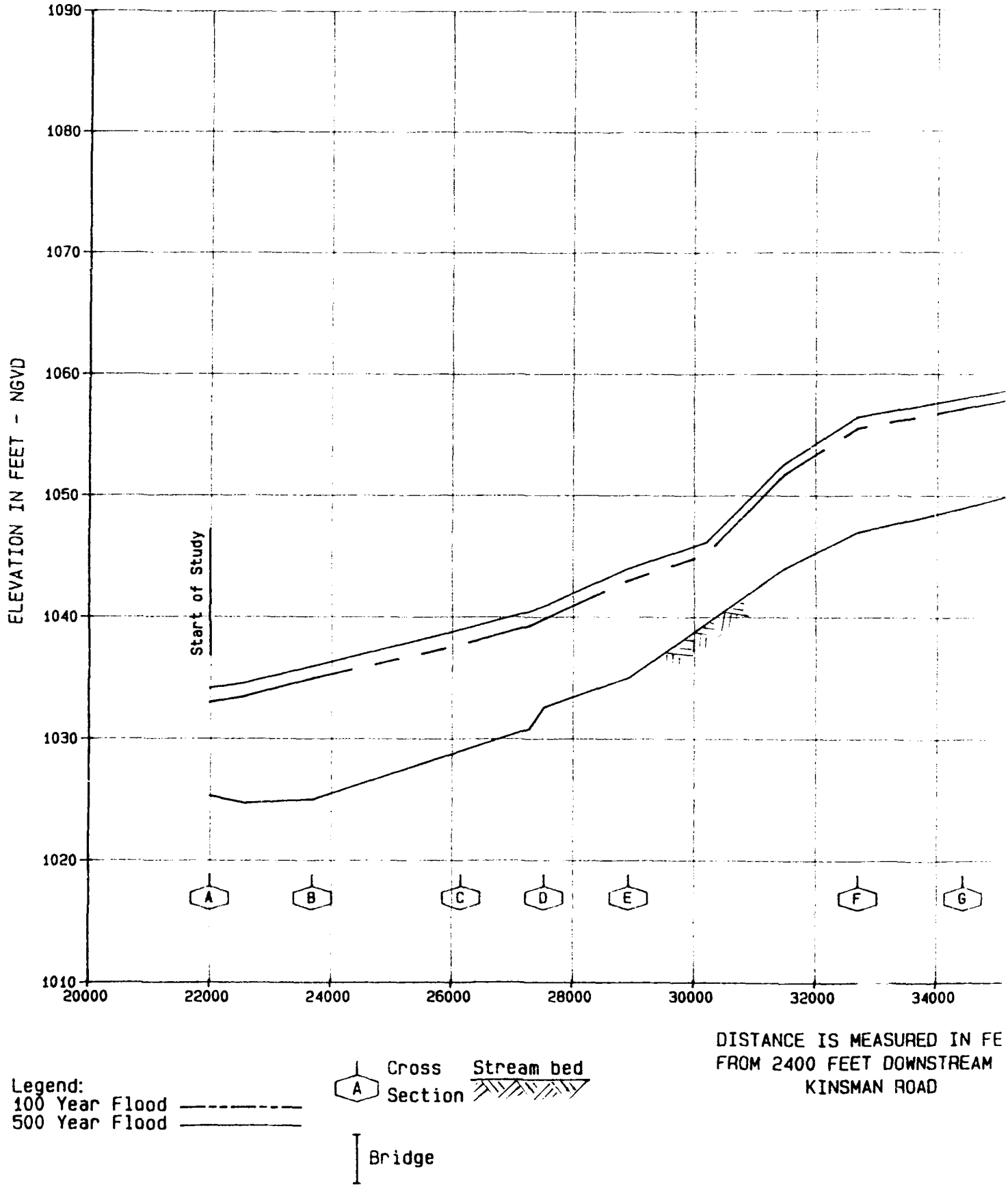
5. U.S. Department of the Interior, Geologic survey, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Burton, Ohio, Contour Interval 10 feet, 1966; Chardon, Ohio, Contour Interval 10 feet, 1966; Chesterland, Ohio, Contour Interval 10 feet, photorevised 1984; and South Russell, Ohio, Contour Interval 10 feet, photorevised 1984.

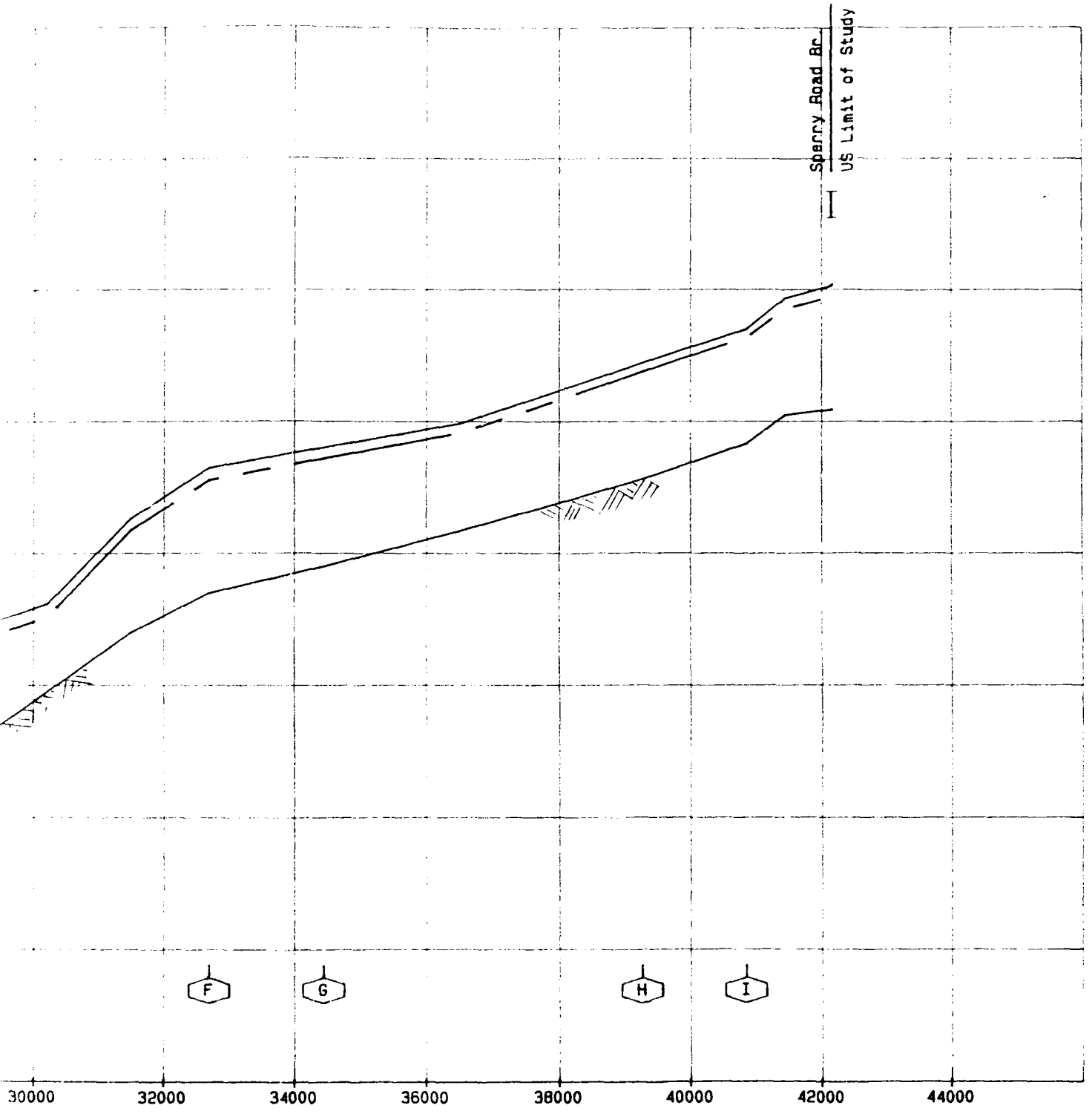
6. U.S. Geological Survey, National Handbook of Recommended Methods for Water Data Acquisition, 1977.

7. Geauga County Topographic Maps, Sheets 61, 62, 63, 70, 71, 72, Scale 1" = 200', Contour Interval 2 feet.

8. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles Generalized Computer Program, Davis, California, 1974.

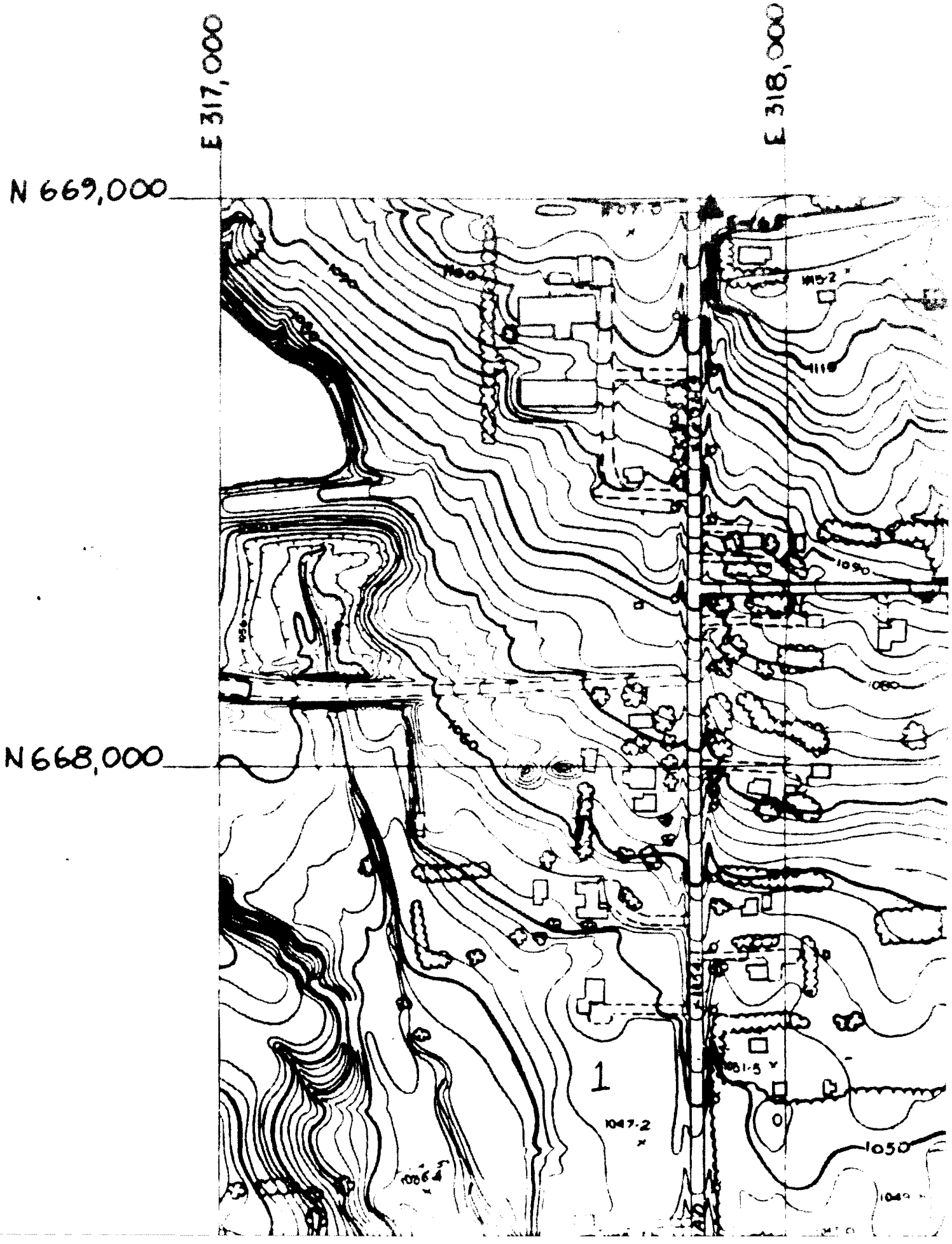
9. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Geauga County, Ohio, (unincorporated areas) November 4, 1988.


ELEVATION IN FEET - NGVD
1090
1080
1070
1060
1050
1040
1030
1020
1010
20000
22000
24000
26000
28000
30000
32000
34000
Start of Study
A
B
C
D
E
F
G
DISTANCE IS MEASURED IN FE
FROM 2400 FEET DOWNSTREAM
KINSMAN ROAD
Legend:
100 Year Flood
500 Year Flood
Cross Section
Stream bed
Bridge



DISTANCE IS MEASURED IN FEET
FROM 2400 FEET DOWNSTREAM OF
KINSMAN ROAD

FLOOD PROFILE
CHAGRIN RIVER
GEAUGA COUNTY, OHIO
PLATE 1 of 1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N 669,000
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1115.2
1081.5
1064

E 318,000

E 318,400

E 320,0

E 321,000

N 669,000

MATCHES SHEET 2

N 668,000


667,000
666,000
CHILLICOTHE ROAD
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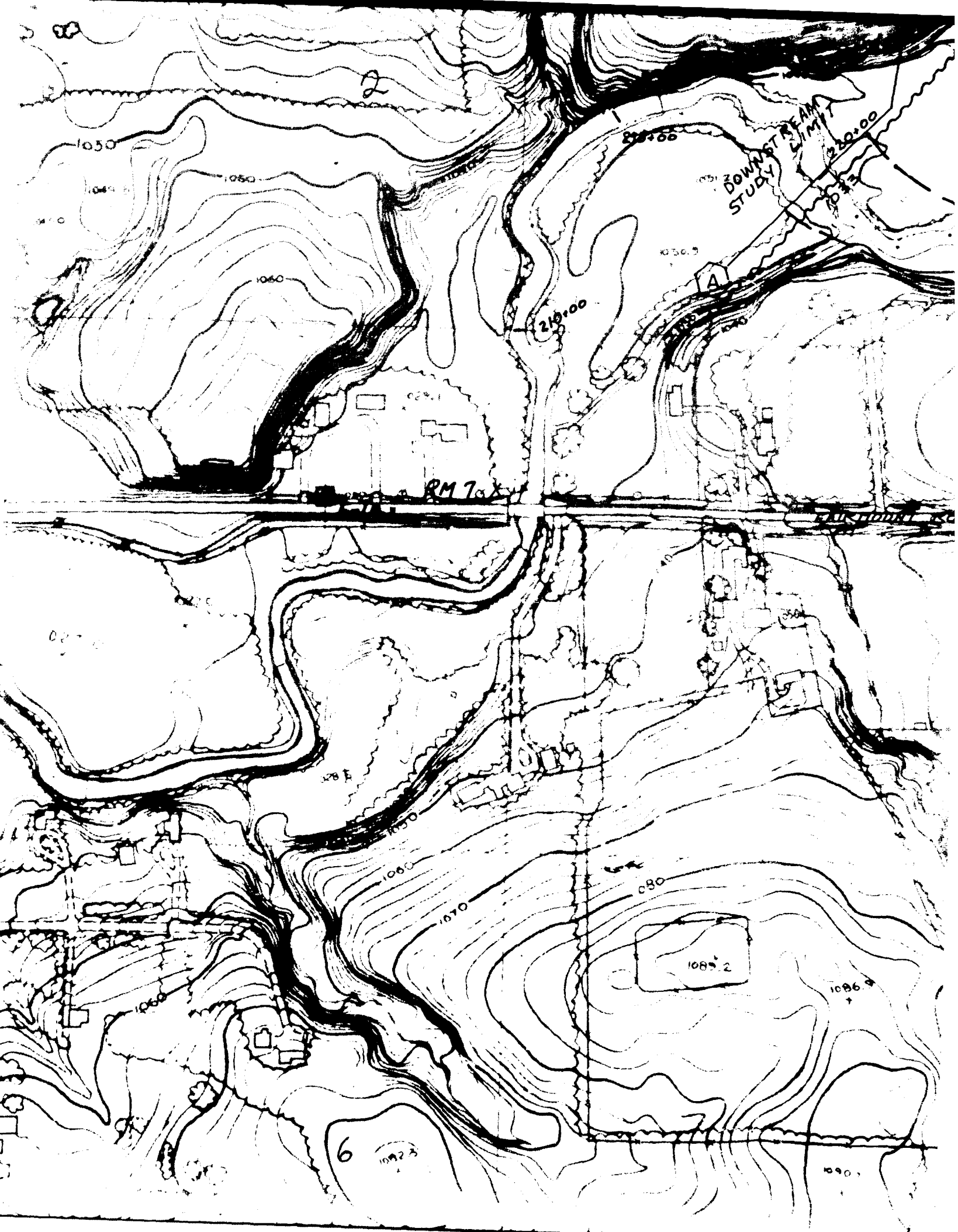
5
S-16N


DOWNSTREAM
STUDY
LIMIT
RM 7
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1080
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1086.7
1090.1
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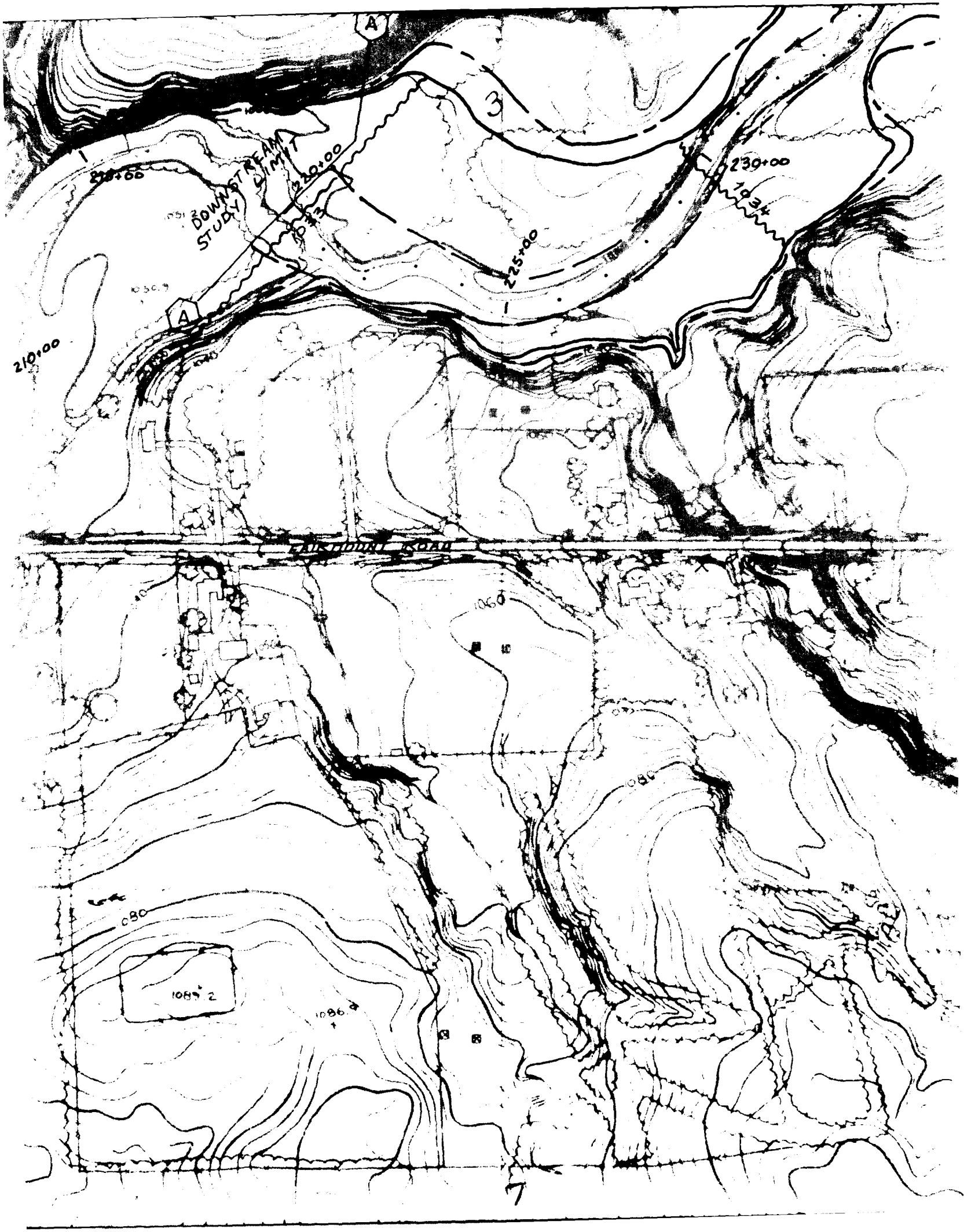
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DOWNSTREAM
STUDY
LIMIT
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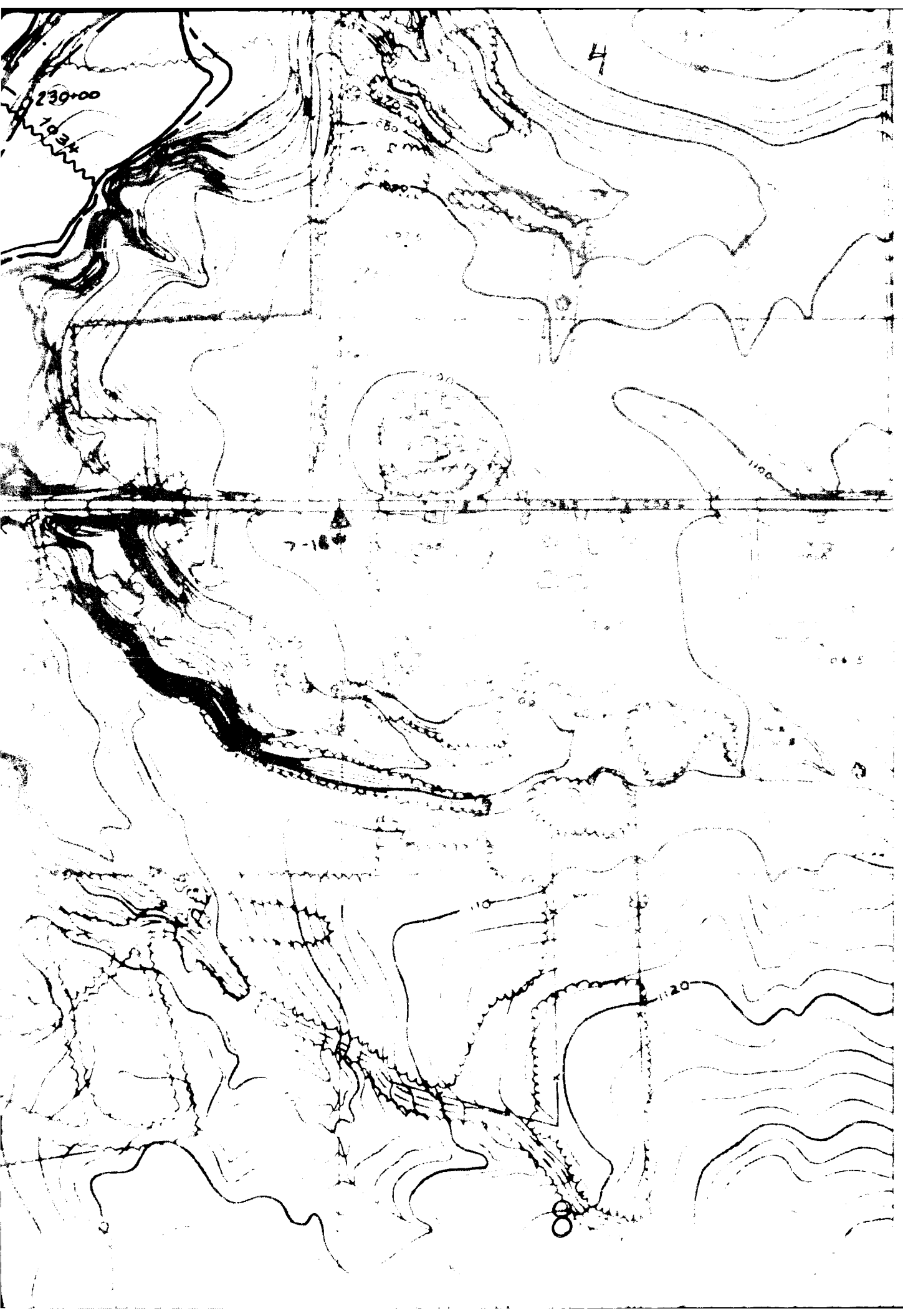
225+00
210+00
A
1080
1085
1086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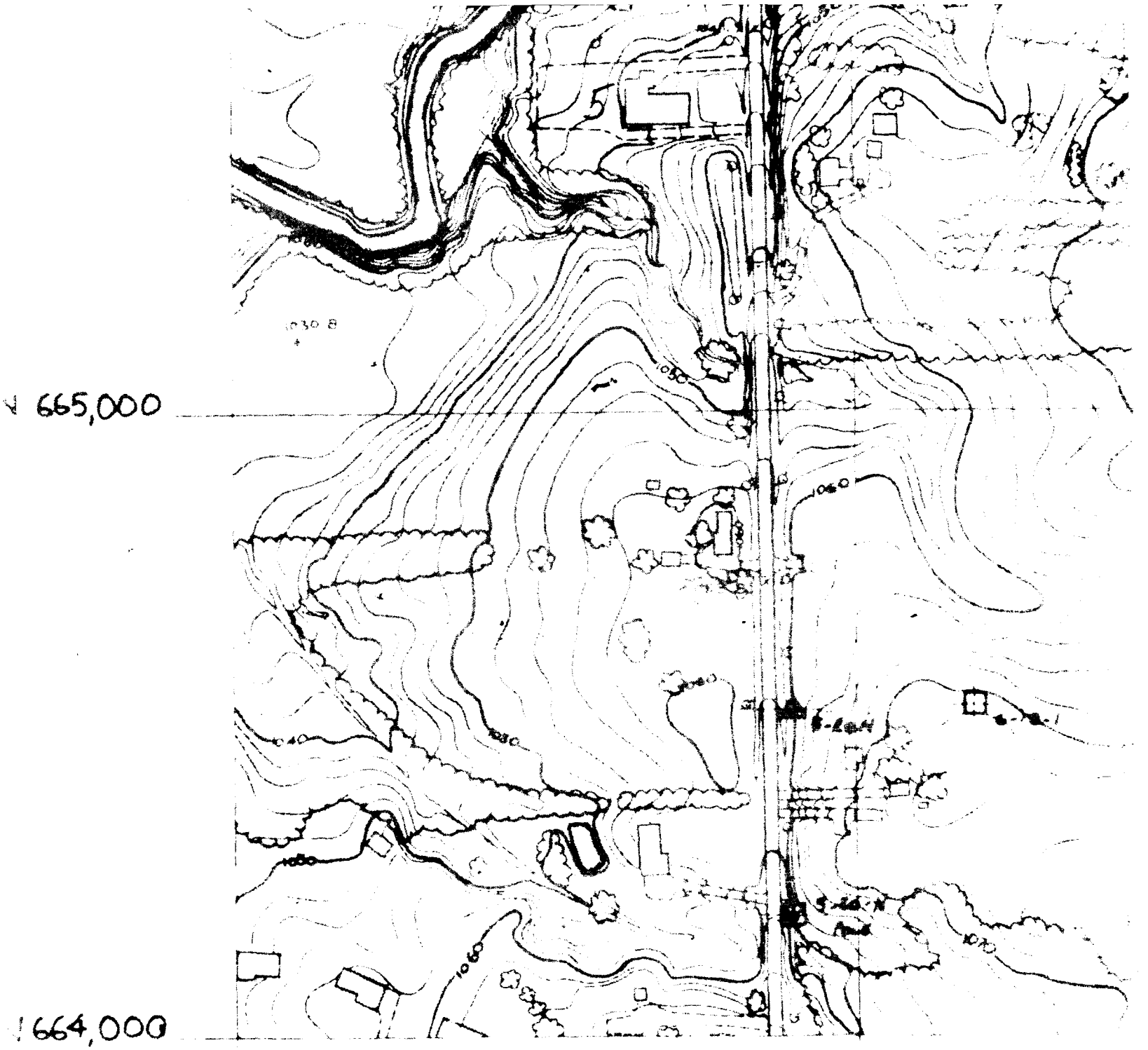
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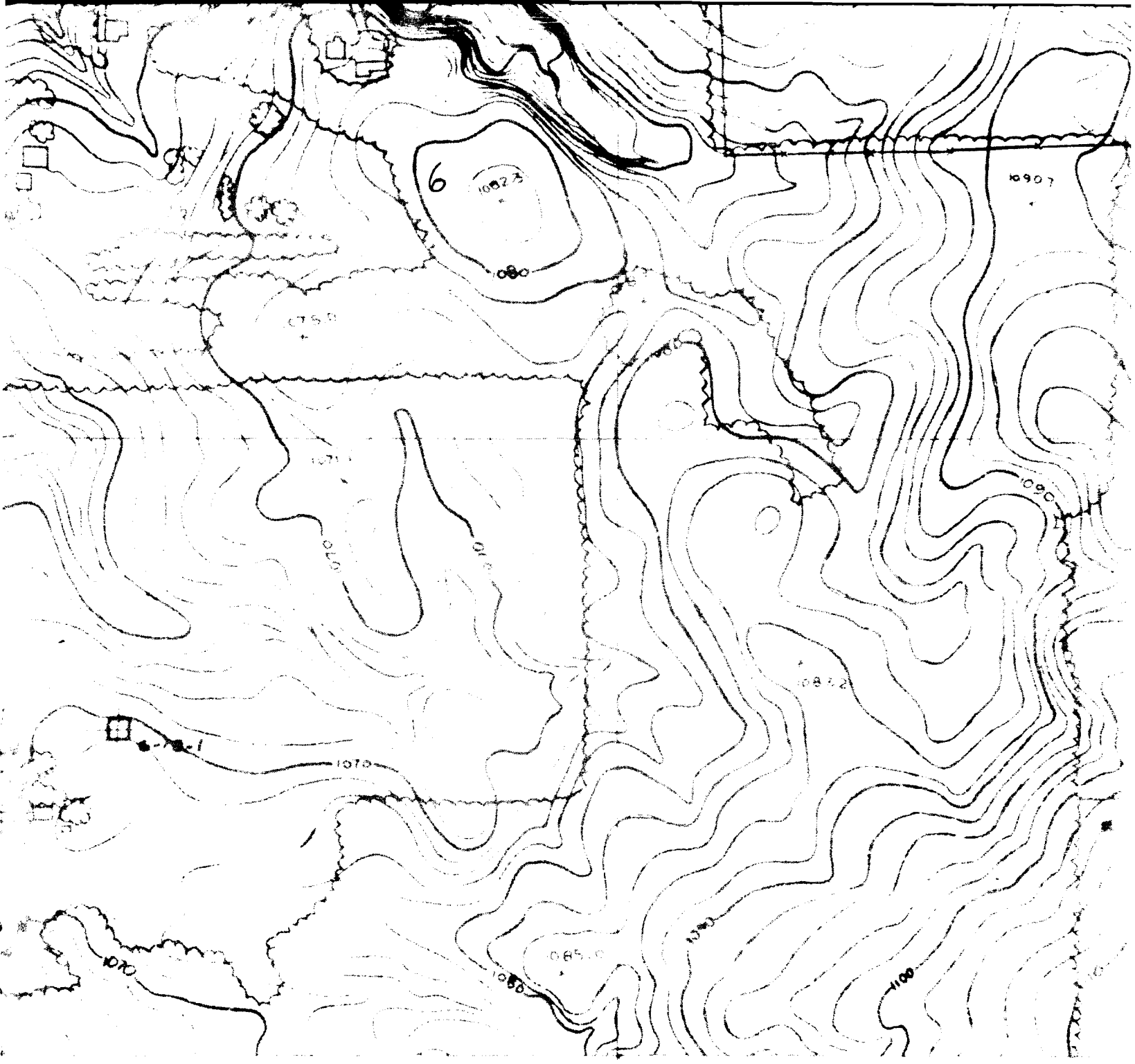
RM-1 X



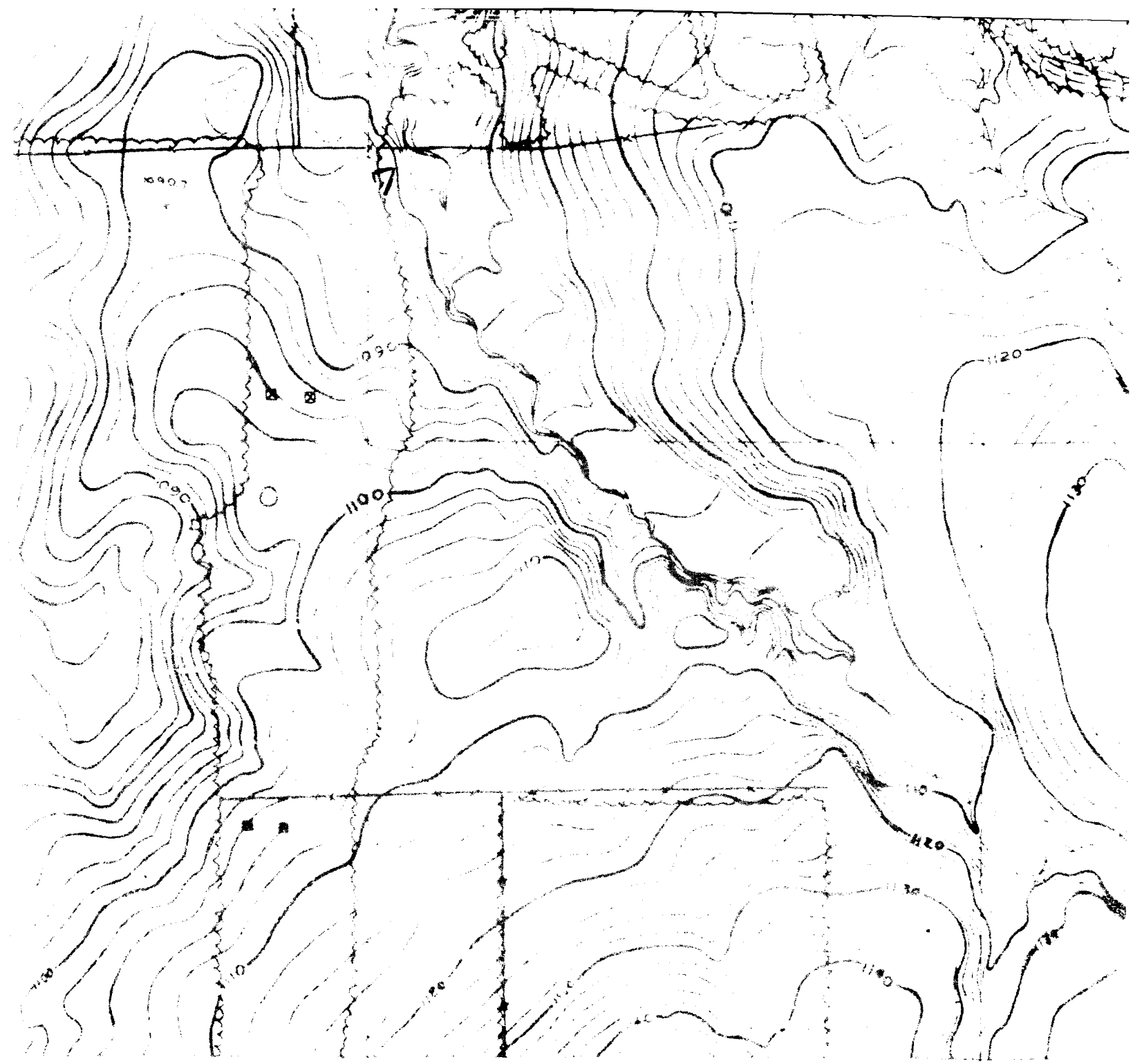
LEGEND

- 500-YEAR FLOOD PLAIN BOUNDARY
- 100-YEAR FLOOD PLAIN BOUNDARY
- FLOODWAY LIMITS
- CROSS SECTION LOCATION
- 1020 BASE FLOOD ELEVATION
- RM-1 X ELEVATION REFERENCE MARK

DISTANCE IS MEASURED IN F
DOWNSTREAM OF KINSMAN

SCALE
1 INCH = 200 FEET

319,080



INDEX TO SHEETS

	3	4
(1)	2	5

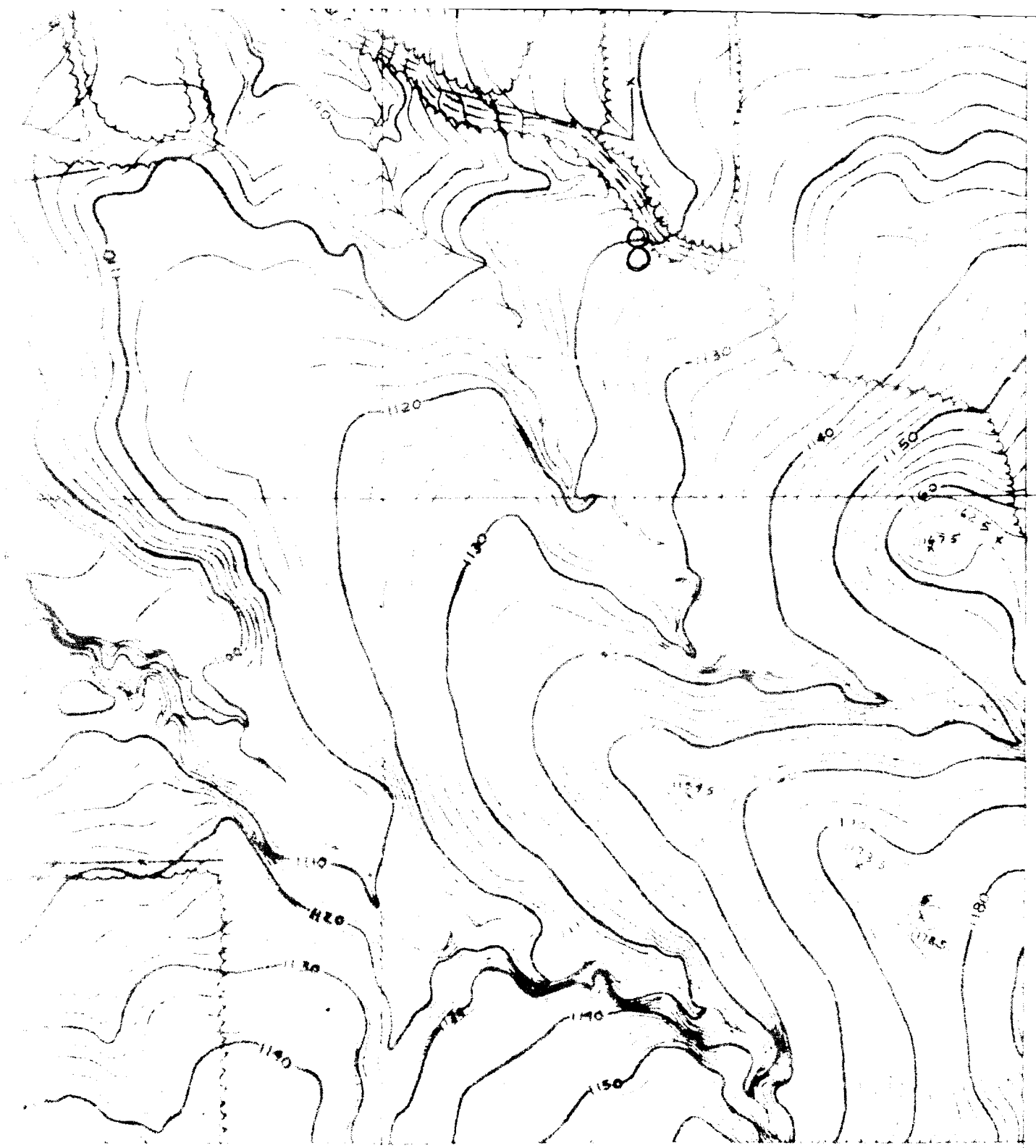
STANCE IS MEASURED IN FEET FROM 2400 FEET
OWNSTREAM OF KINSMAN ROAD.

SCALE
1 INCH = 200 FEET

E 320,000

E 321,000

11



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E 321,000

E 322,000

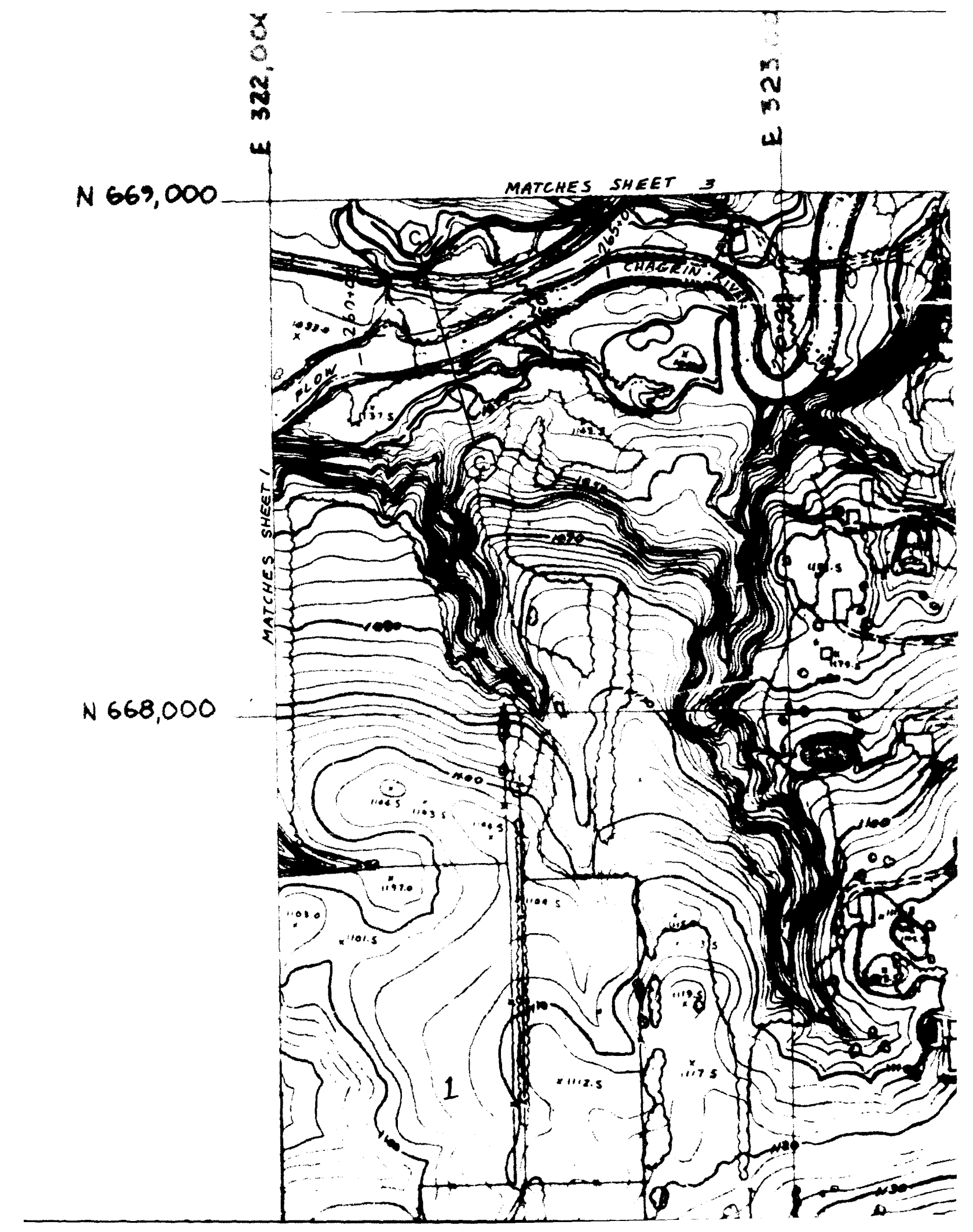
U.S. Army Engineer District, Buffalo
SPECIAL FLOOD HAZARD EVALUATION

FLOODED AREA MAP

CHAGRIN RIVER

GEAUGA COUNTY, OHIO

SHEET 1 OF 5 SEPT. 1992


E 322,000
E 323
N 669,000
N 668,000
MATCHES SHEET 3
MATCHES SHEET 1
CHAGRIN
FLOW
1

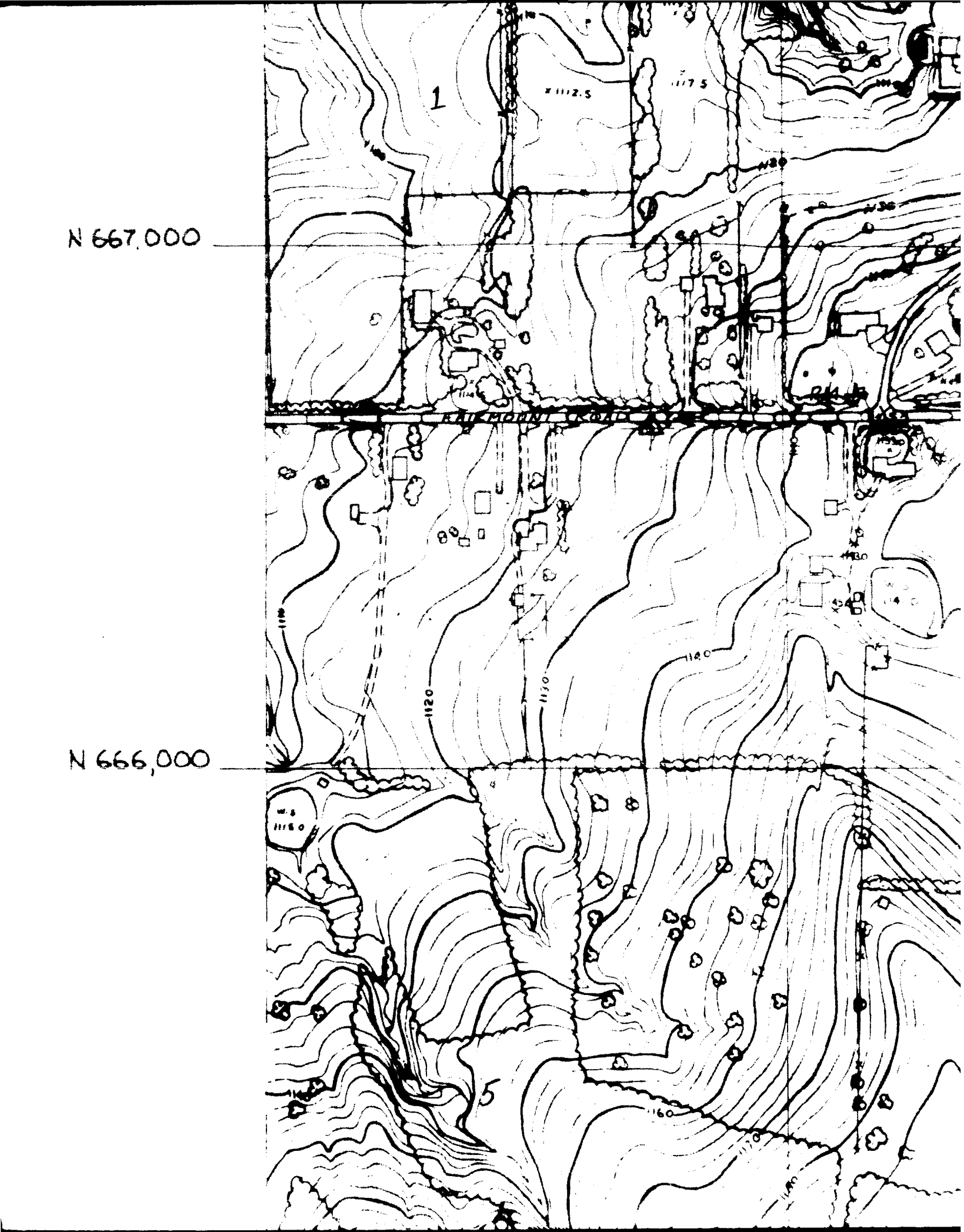
62

E 326,000

E 327,000

N 669,000

N 668,000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N 666,000
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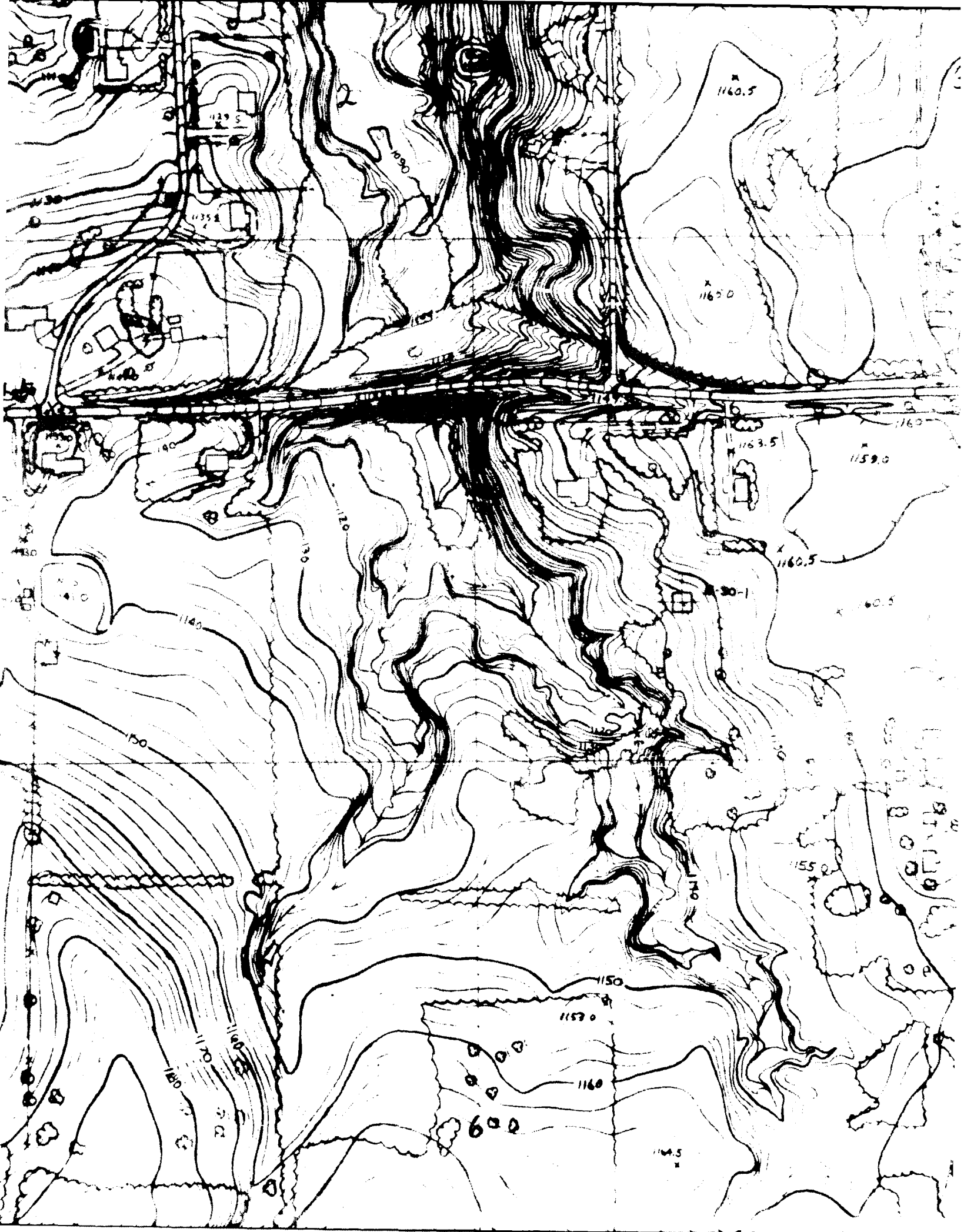
1160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1163.5
1159.0
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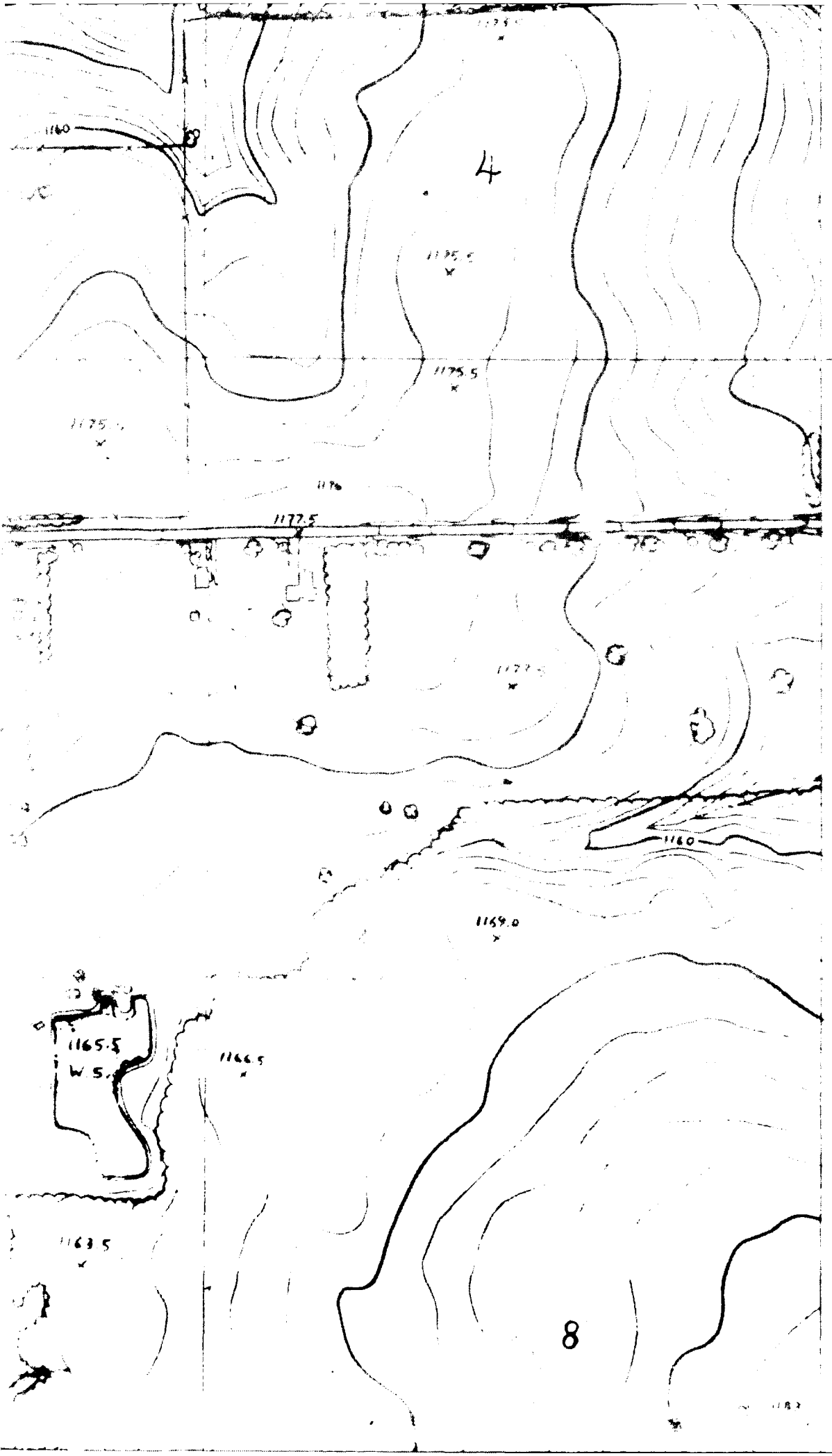
600
1164.5
155.0



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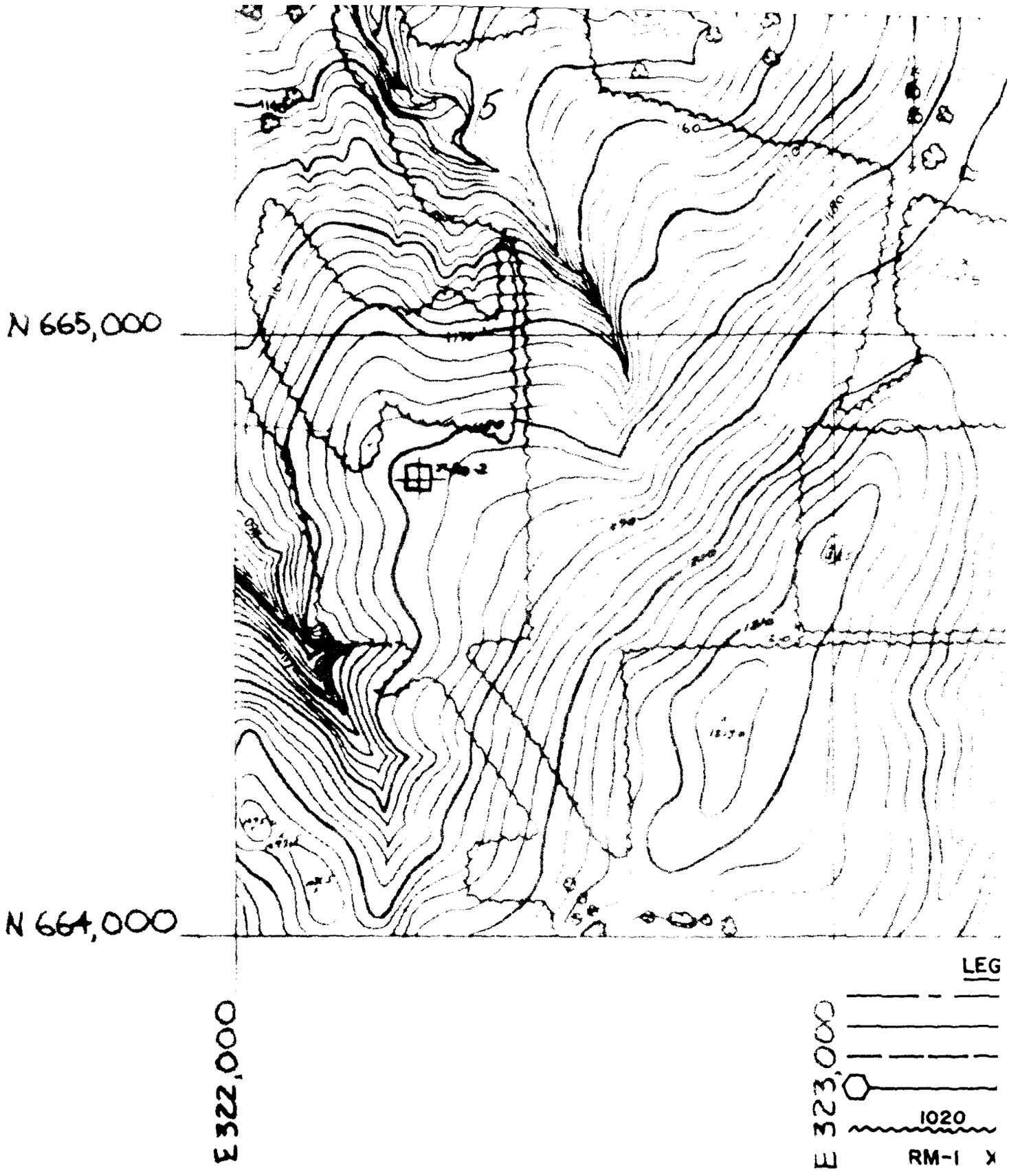
N 666,000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N 664,000
E 322,000
E 323,000
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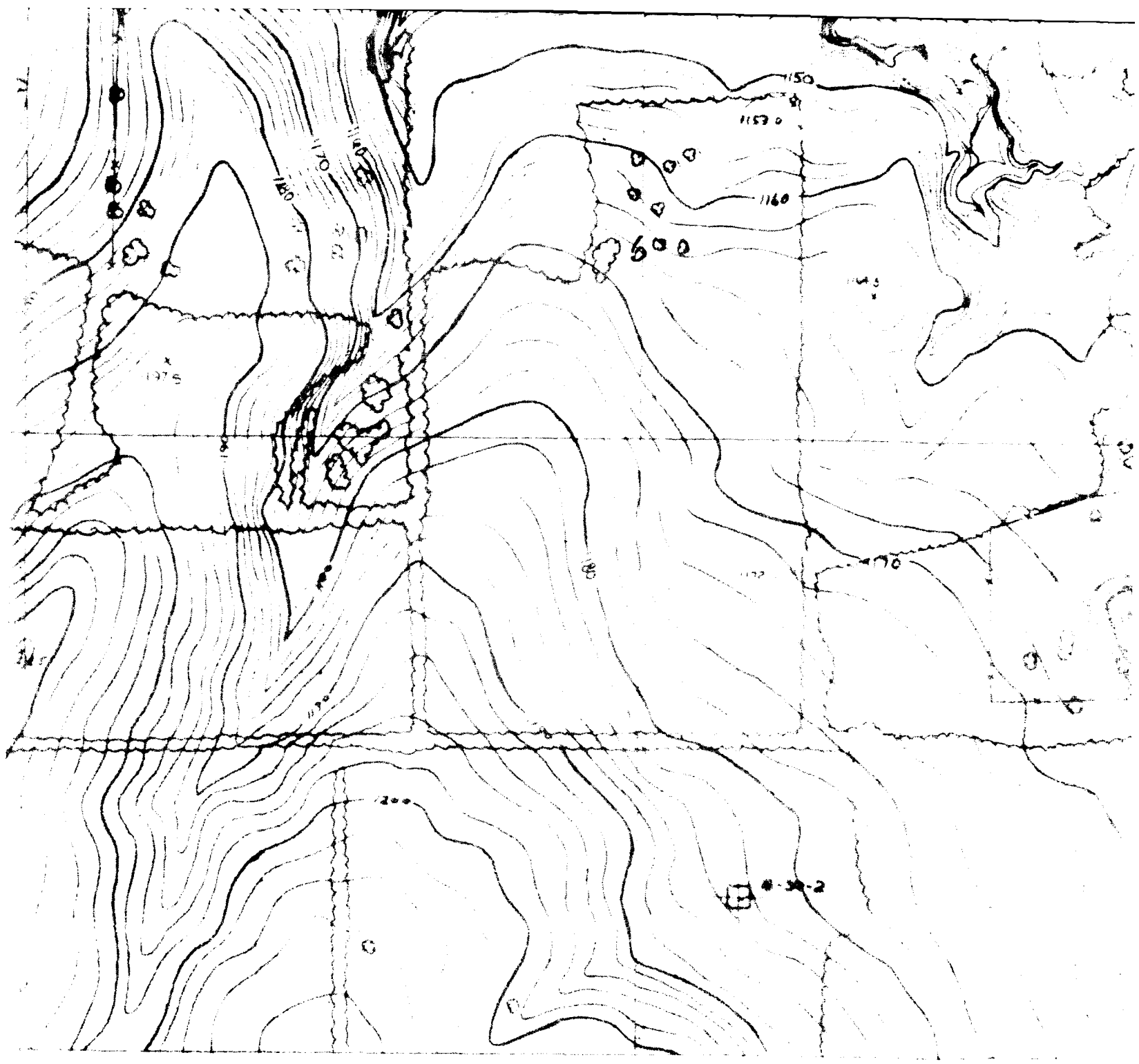
1020
RM-1

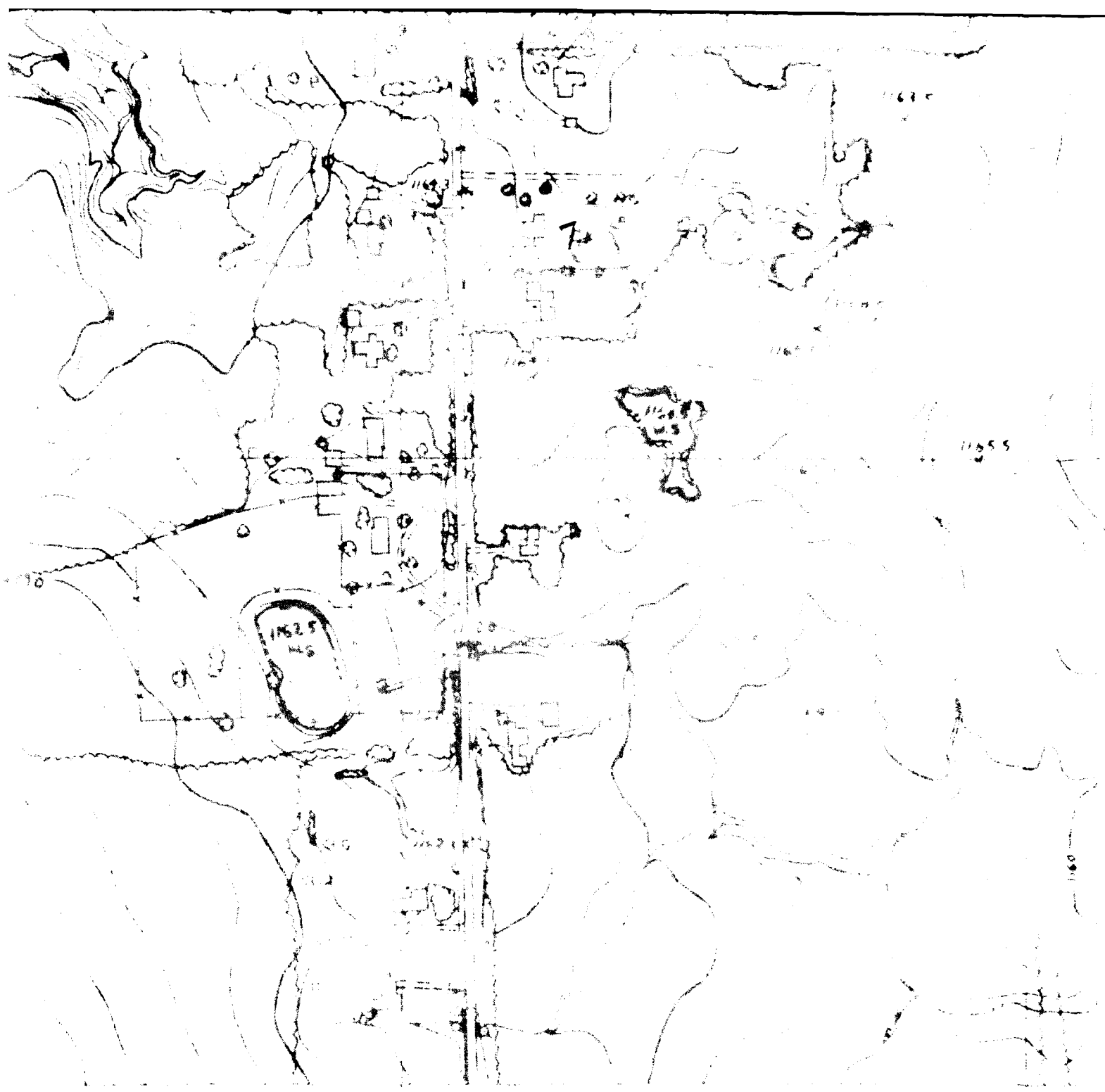


LEGEND

- 500-YEAR FLOOD PLAIN BOUNDARY
- 100-YEAR FLOOD PLAIN BOUNDARY
- FLOODWAY LIMITS
- CROSS SECTION LOCATION
- 1020 BASE FLOOD ELEVATION
- RM-1 X ELEVATION REFERENCE MARK

DISTANCE IS MEASURED IN FEET DOWNSTREAM OF KINSMAN ROA

SCALE
1 INCH = 200 FEET



INDEX TO SHEETS

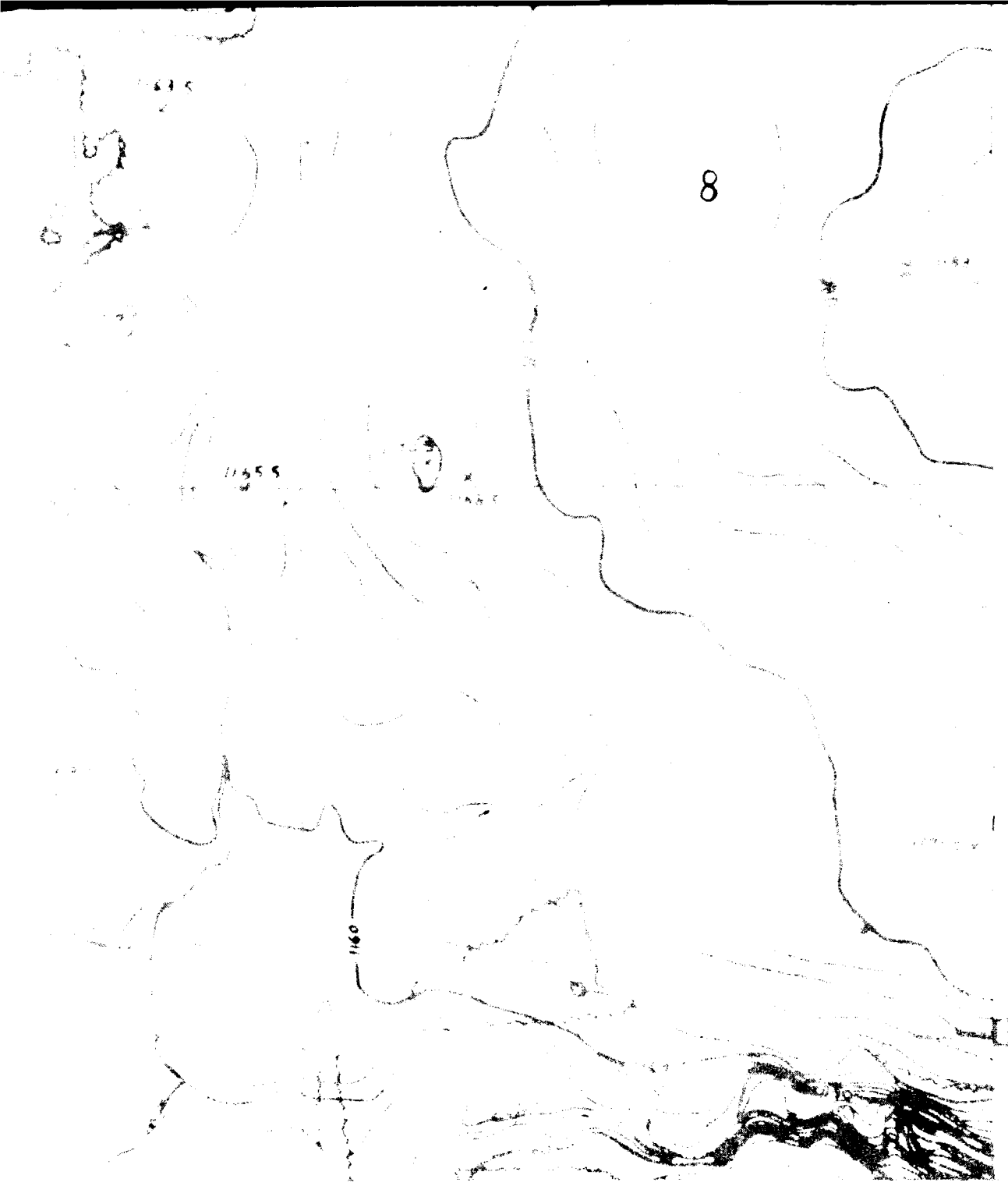
	3	4
1	(2)	5

CE IS MEASURED IN FEET FROM 2400 FEET
TREAM OF KINSMAN ROAD.

E 325,000

E 326,000

SCALE
INCH = 200 FEET



U. S. Army Engineer District, Buffalo
SPECIAL FLOOD HAZARD EVALUATION

FLOODED AREA MAP

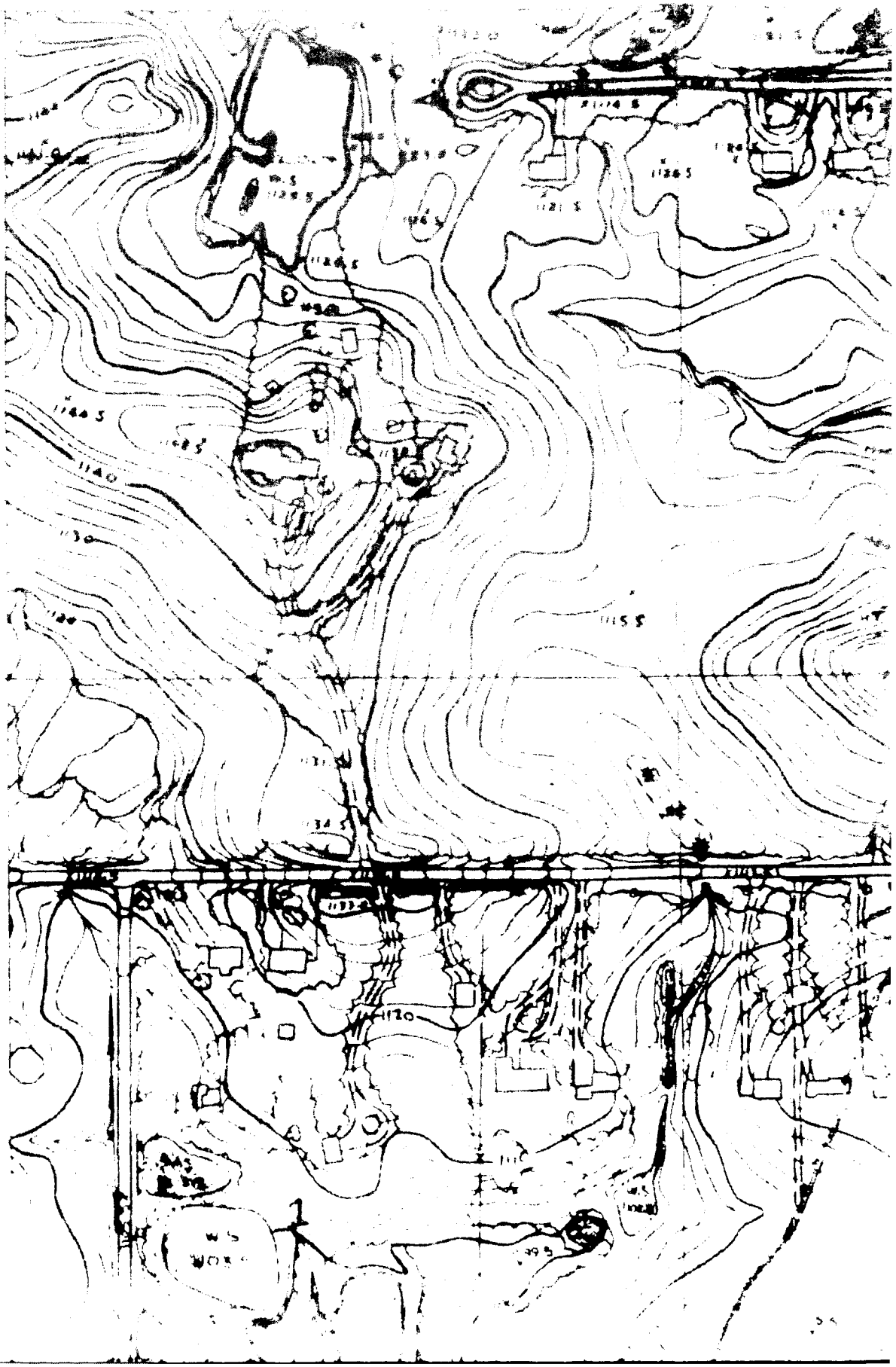
CHAGRIN RIVER

GEAUGA COUNTY, OHIO

SHEET 2 OF 5 SEPT. 1992

E 322 000

N674,000



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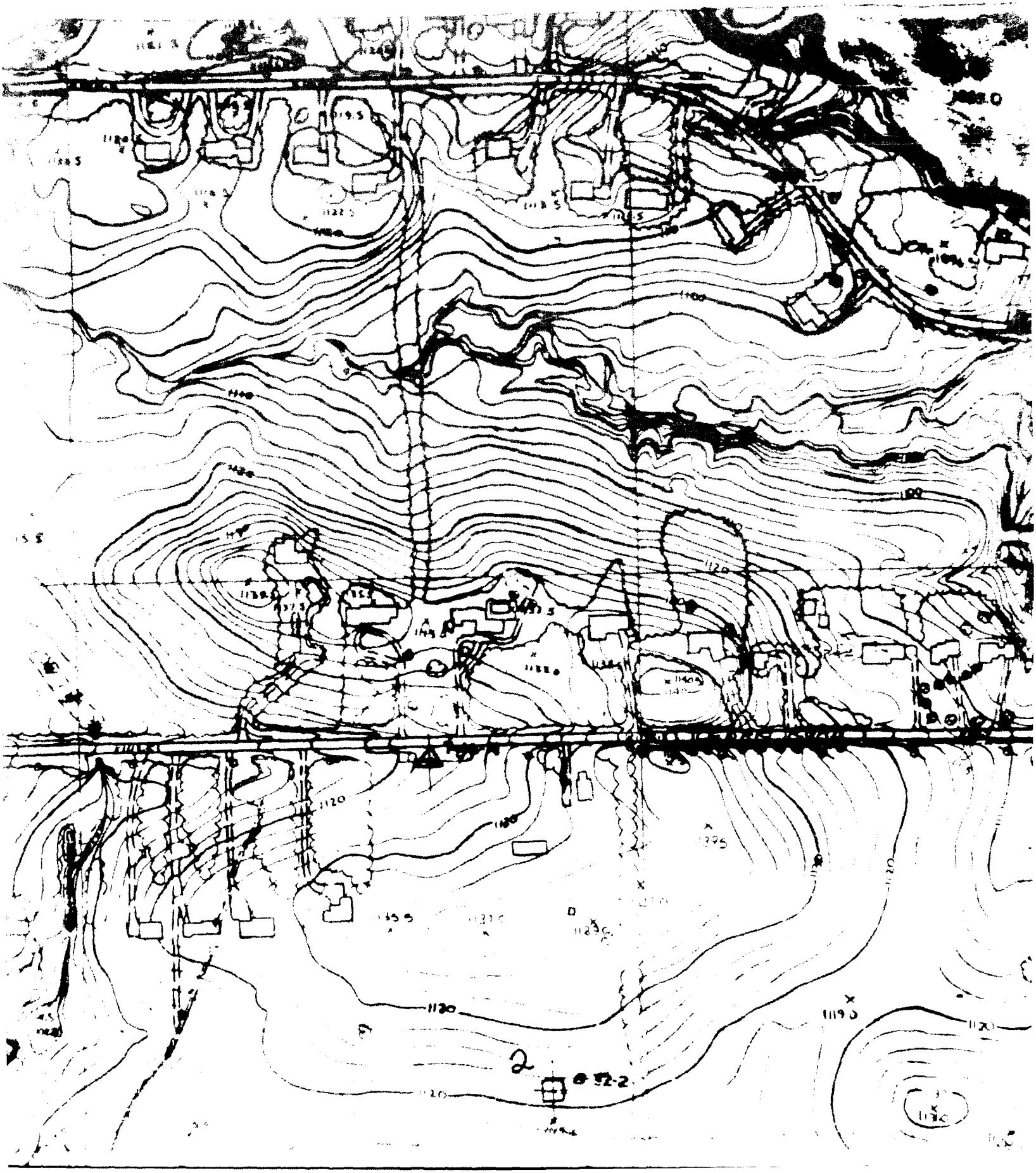
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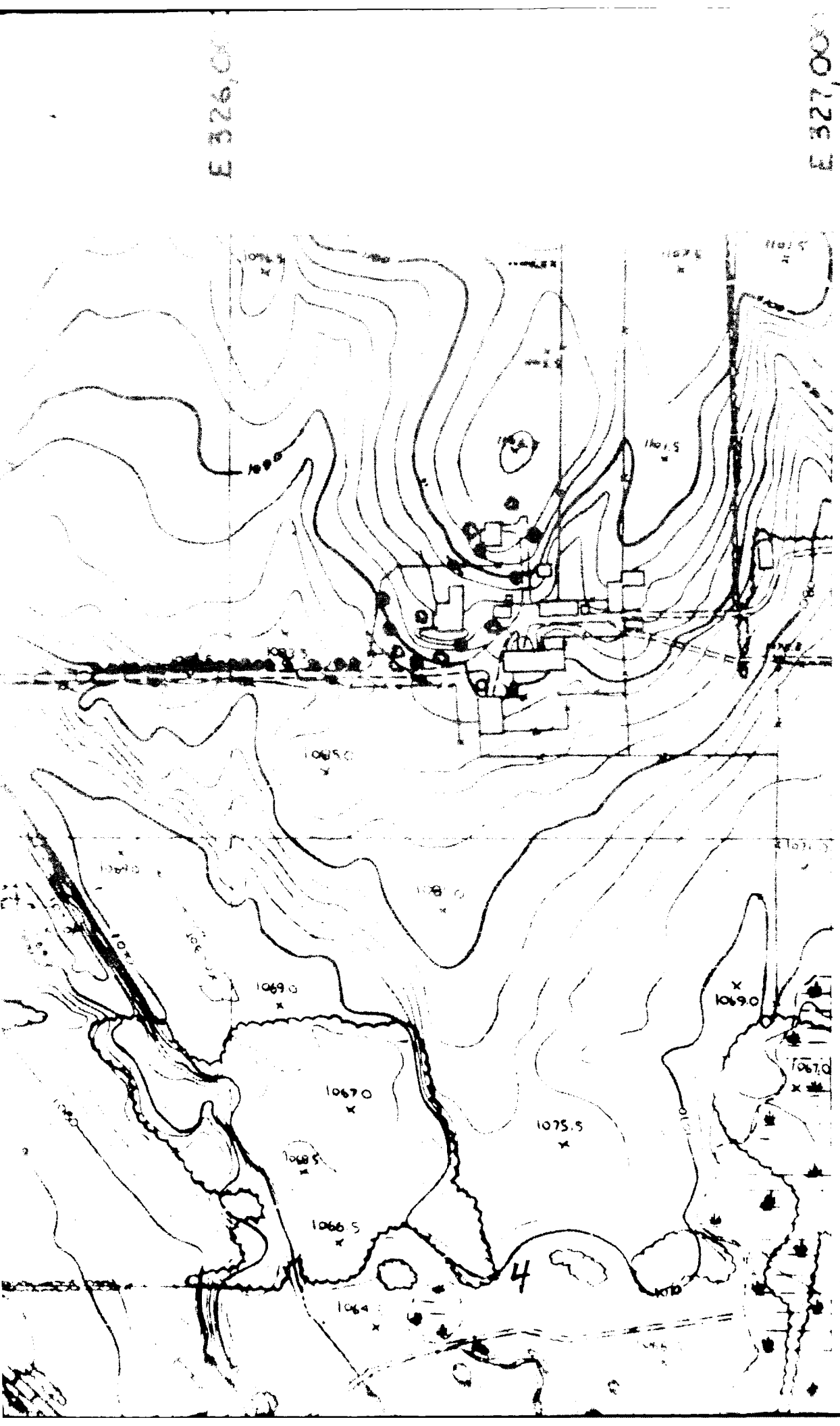
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E 327,000
N674,000
N673,000
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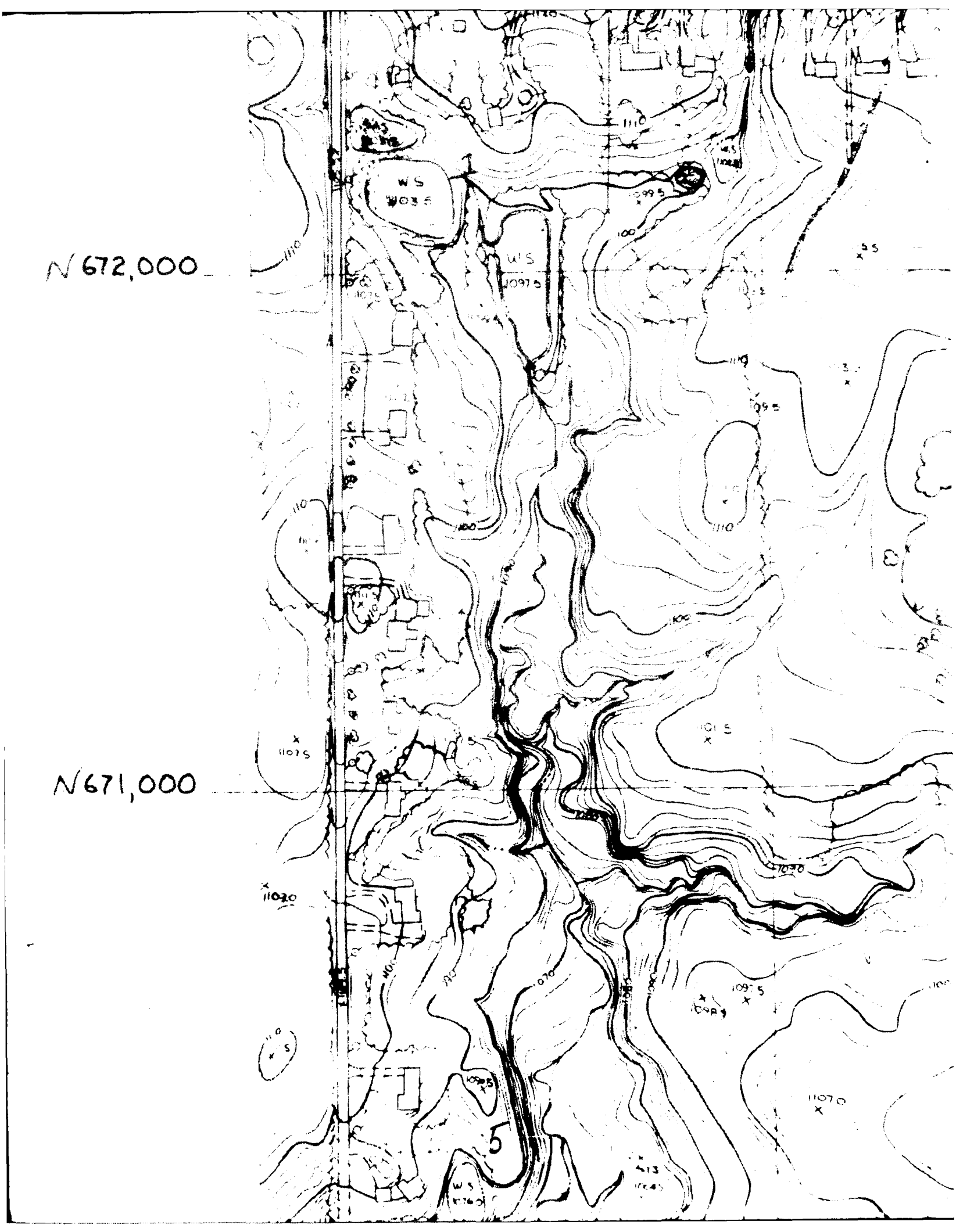
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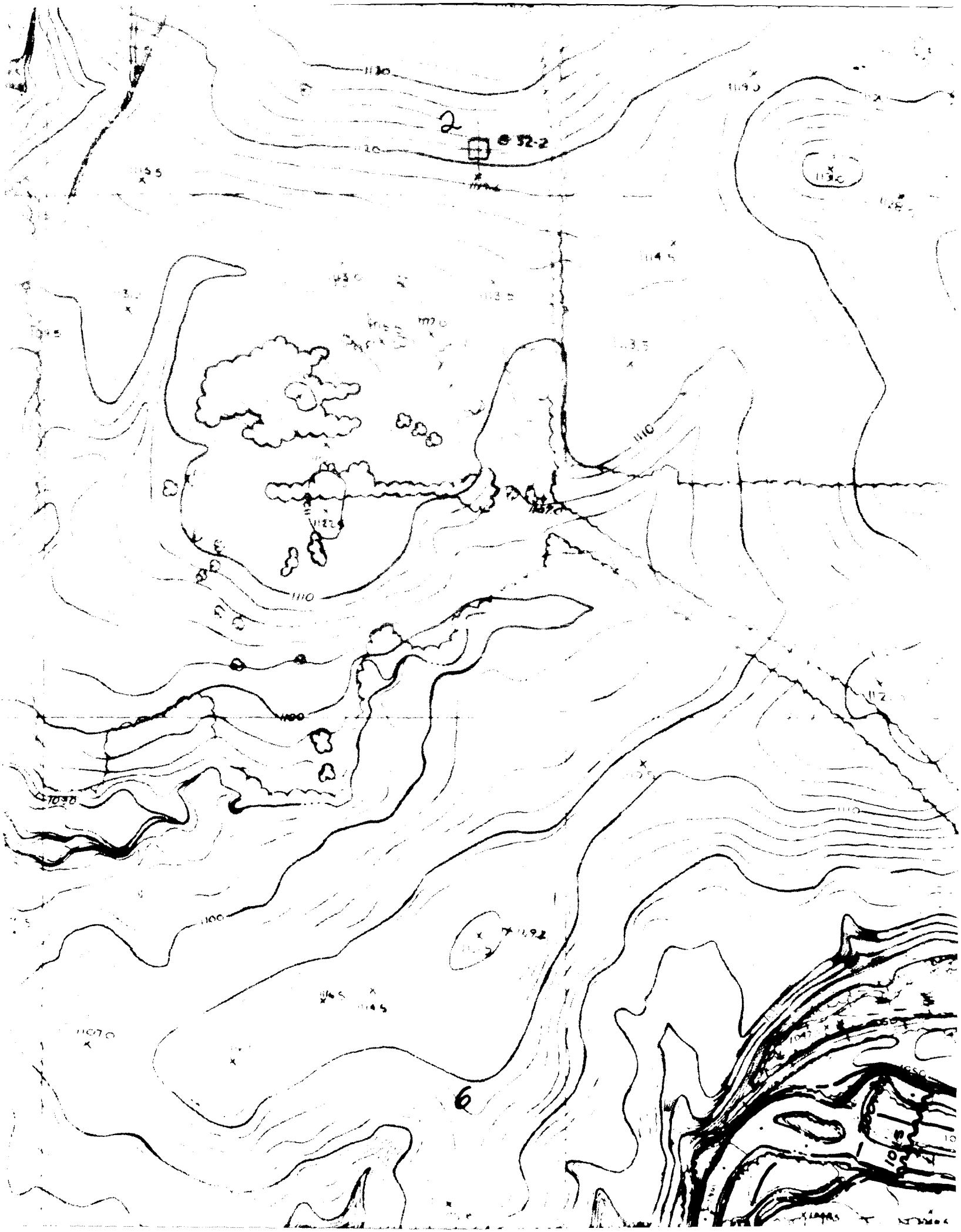
N 671,000
W S
W S
1107 5
1101 5
1110 20
1107 0
5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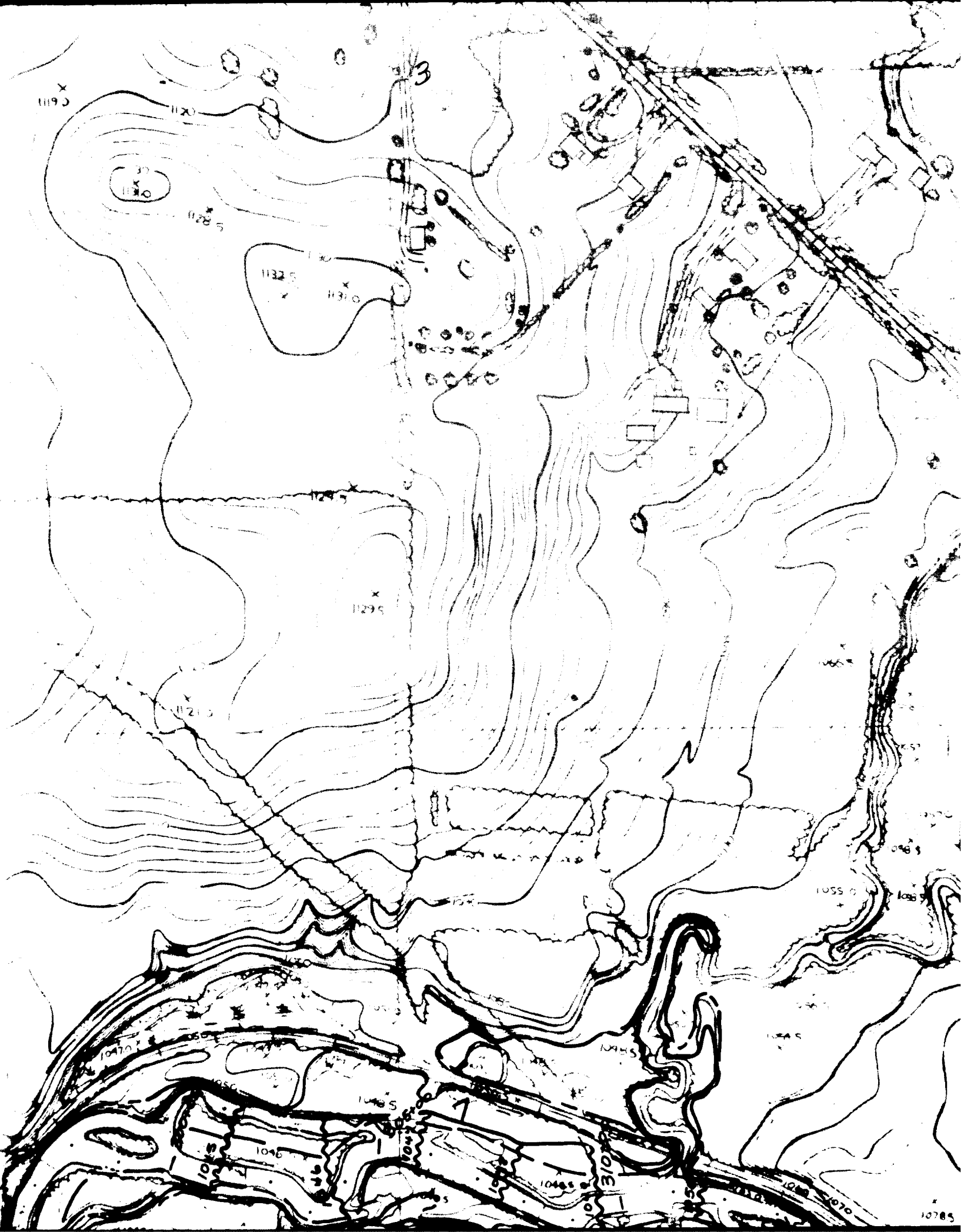
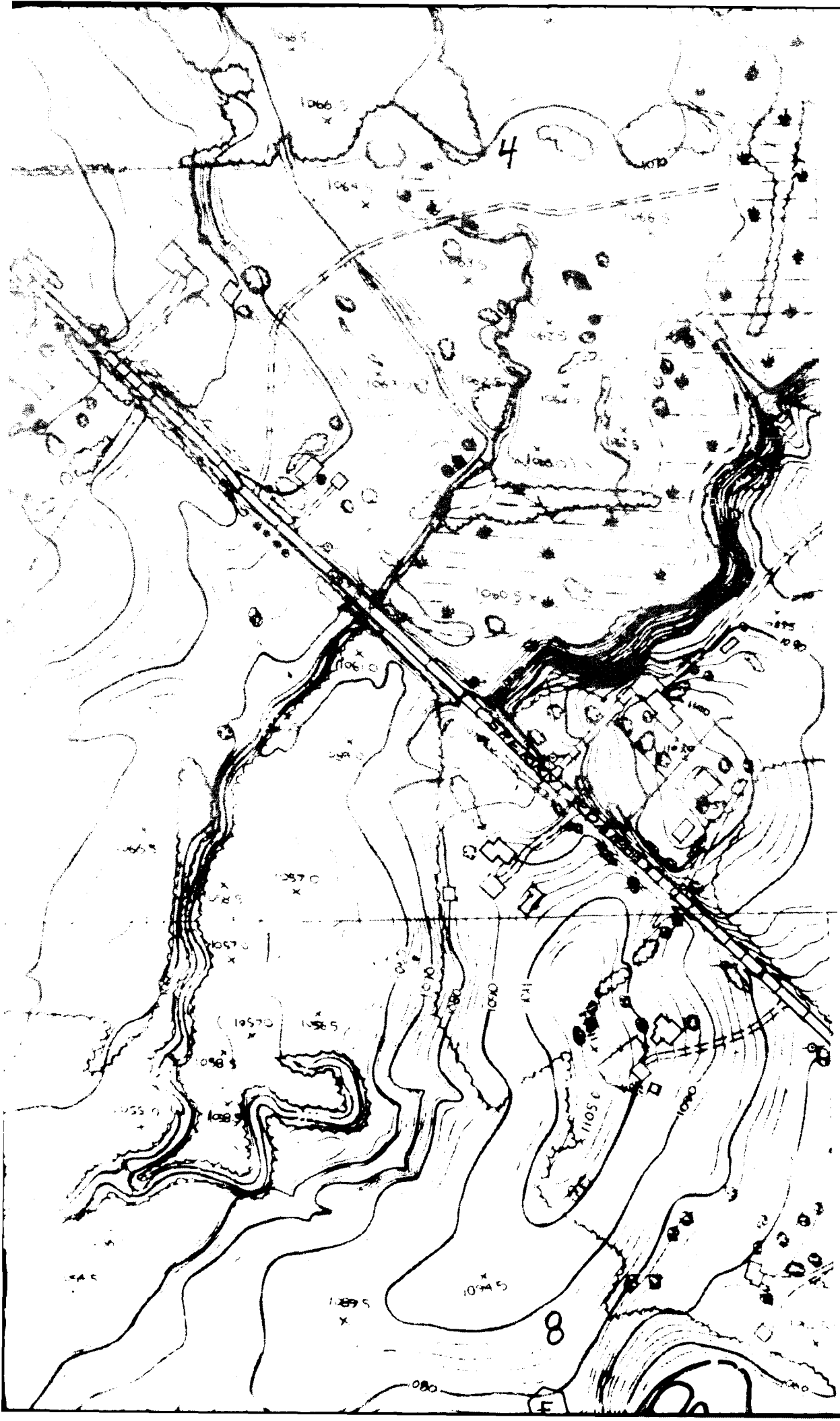
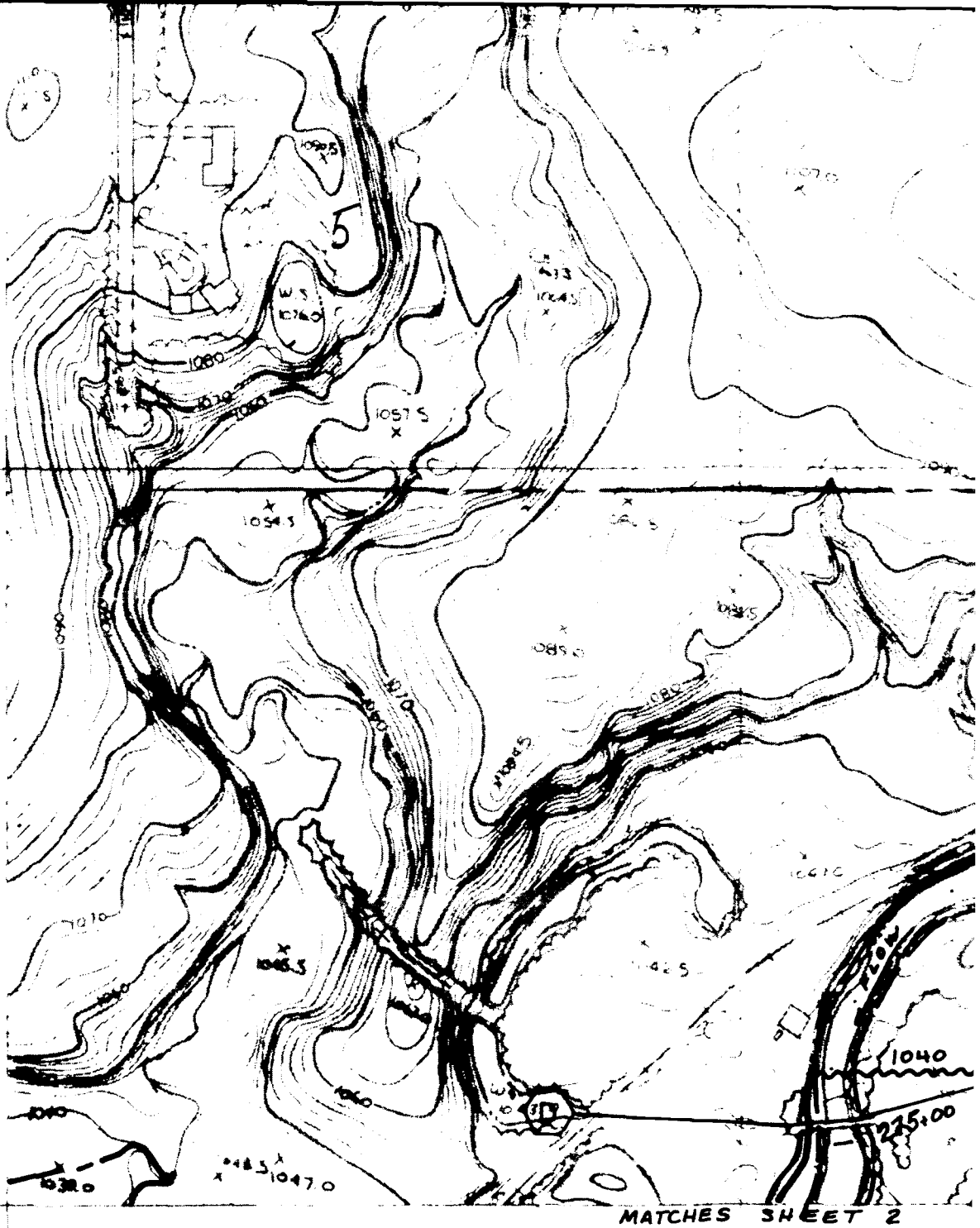




N672,000

N671,000

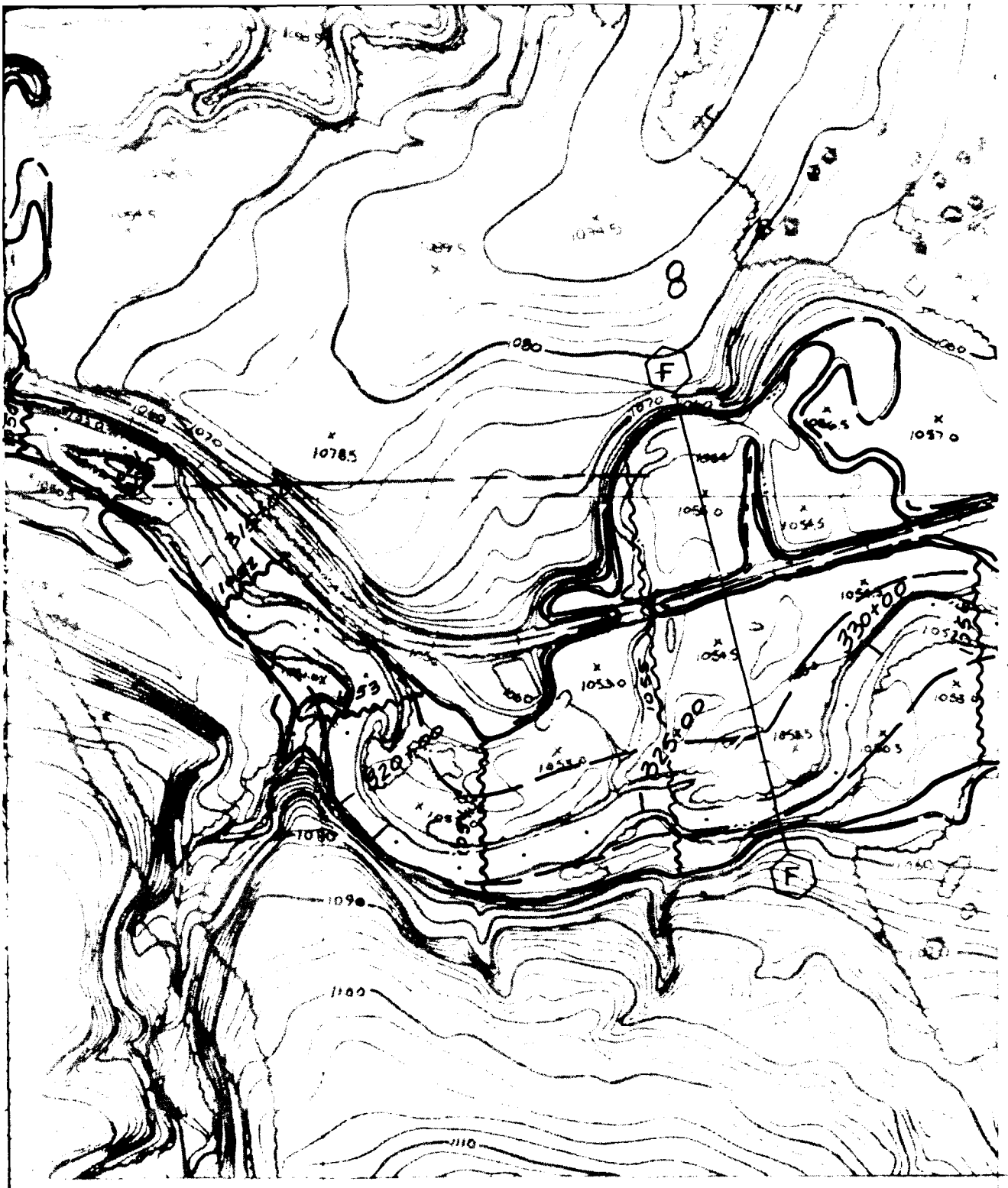

N 670,000
N 669,000
E 322 000
E 323,000
5
1040
1030
MATCHES SHEET 2
LEGE
RM-1 X

INDEX TO SHEETS

	(3)	4
1	2	5

DISTANCE IS MEASURED IN FEET FROM 2400 FEET DOWNSTREAM OF KINSMAN ROAD.

SCALE
1 INCH = 200 FEET



TO SHEETS

3	4
2	5

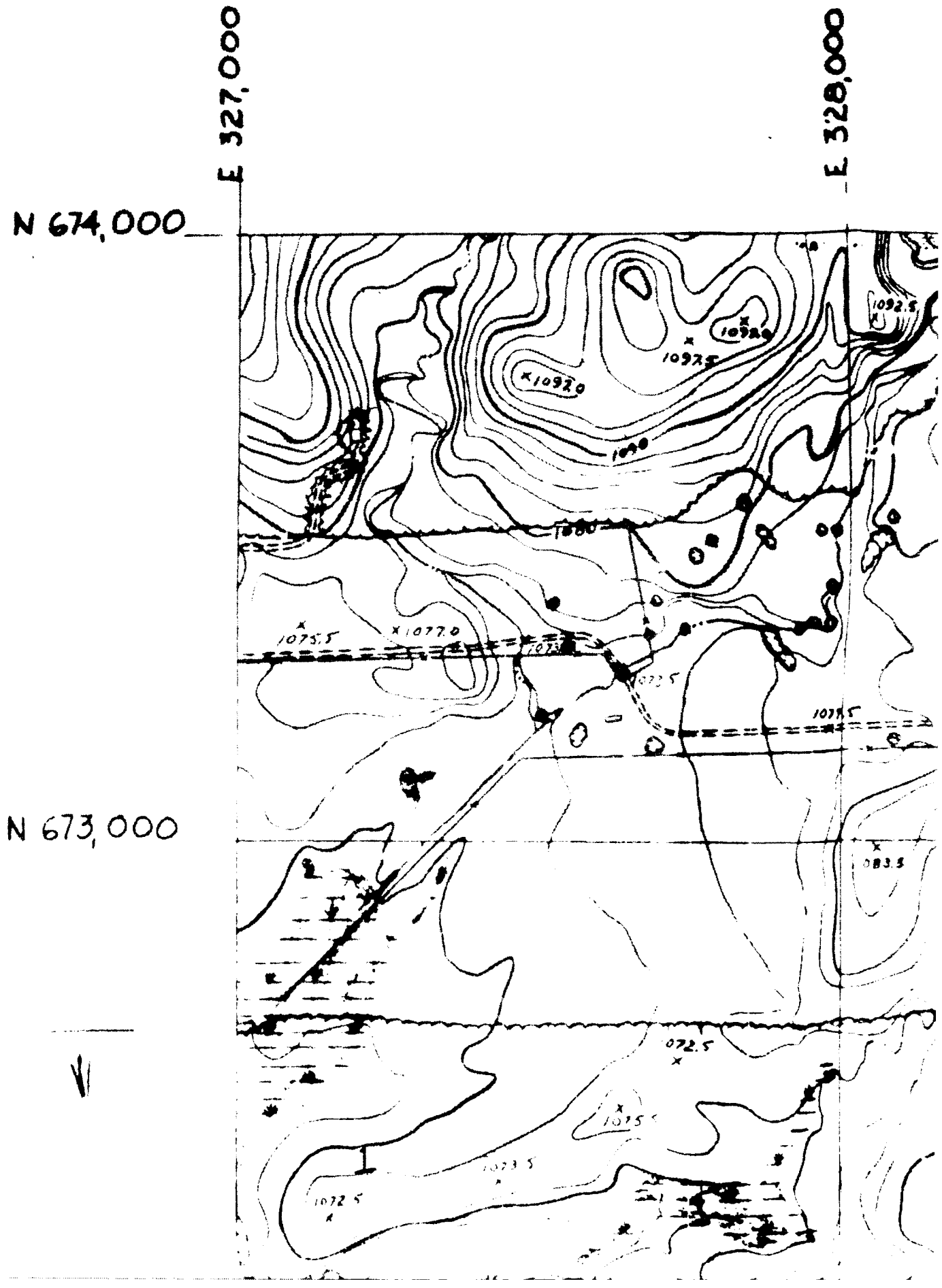
U.S. Army Engineer District, Buffalo
SPECIAL FLOOD HAZARD EVALUATION

FLOODED AREA MAP

CHAGRIN RIVER

GEAUGA COUNTY, OHIO

SHEET 3 OF 5 SEPT. 1992


E 327,000
E 328,000
N 674,000
N 673,000
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1092.5
1092.0
1080
1080
1075.5
1077.0
1077.5
1083.5
1072.5
1072.5
1073.5
1072.5

E 328,000

E 329,000

1086.0

1092.5

1097.5

1083.0

1198.0

1102.5

1099.5

1101.5

1100

1083.5

1083.6

1080

1096.5

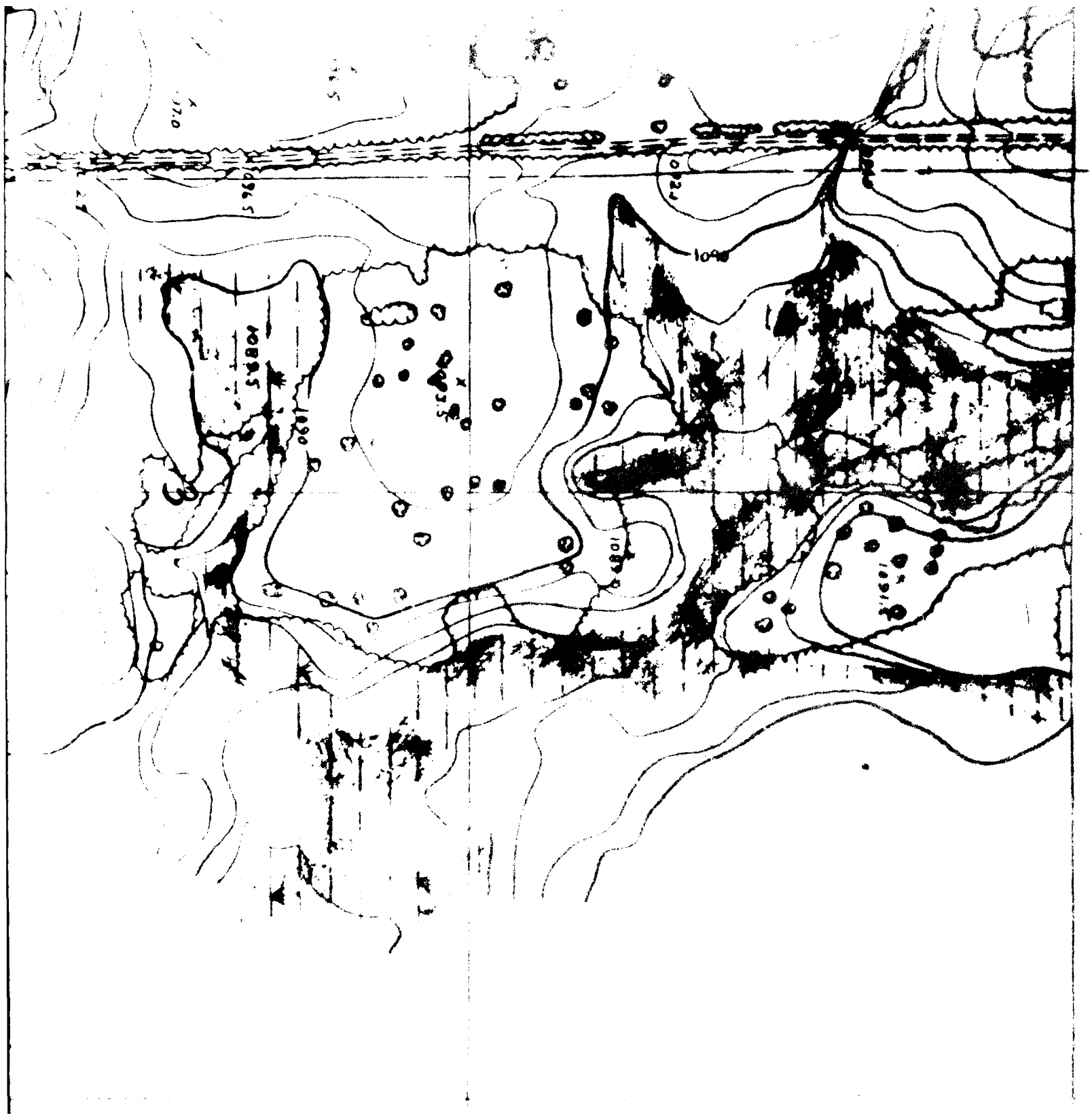
1091.5

1092.0

1101.0

1085.5

1097.0


E 330,000
E 331,000

E 331,000

E 332,000

72

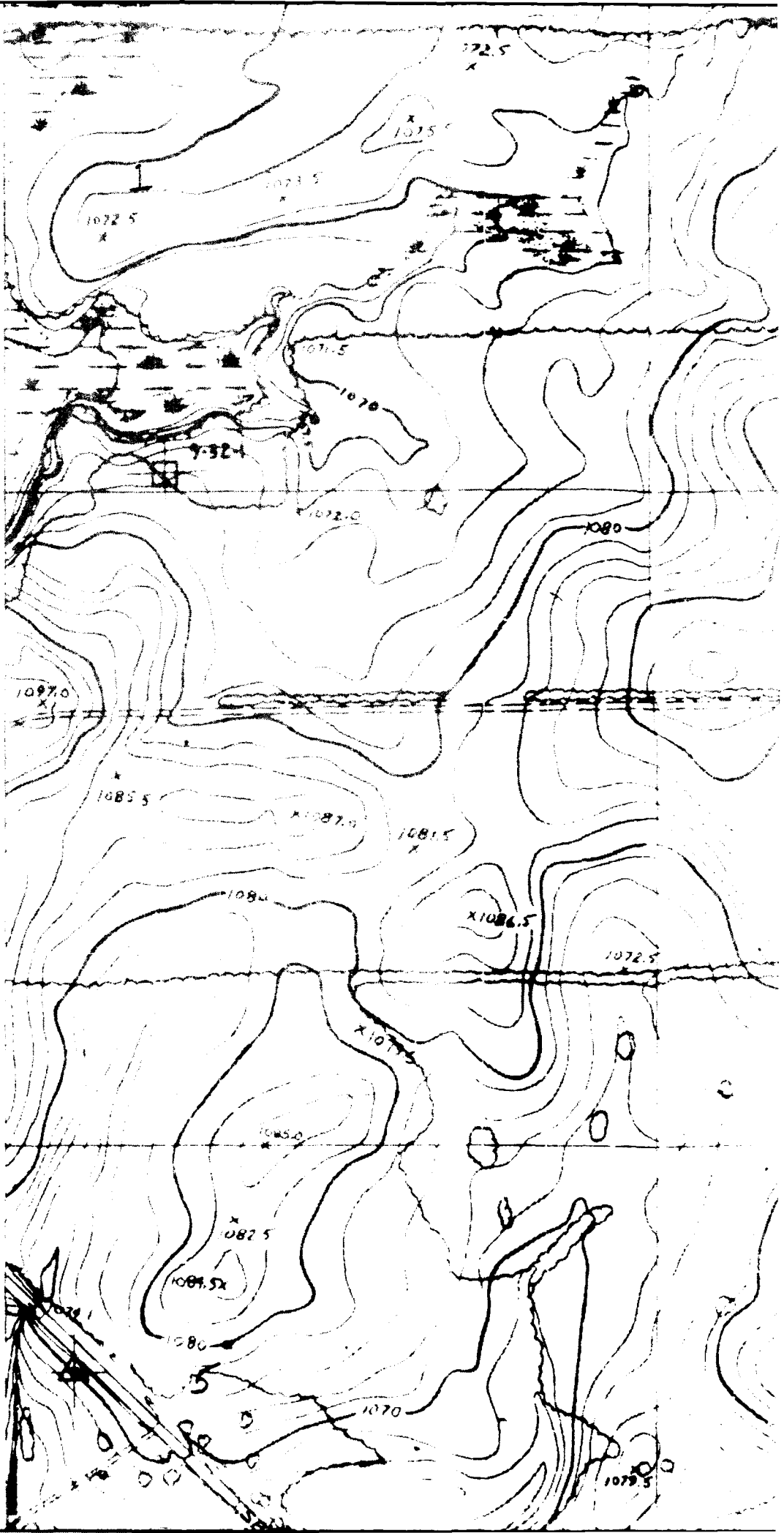
N 674,000

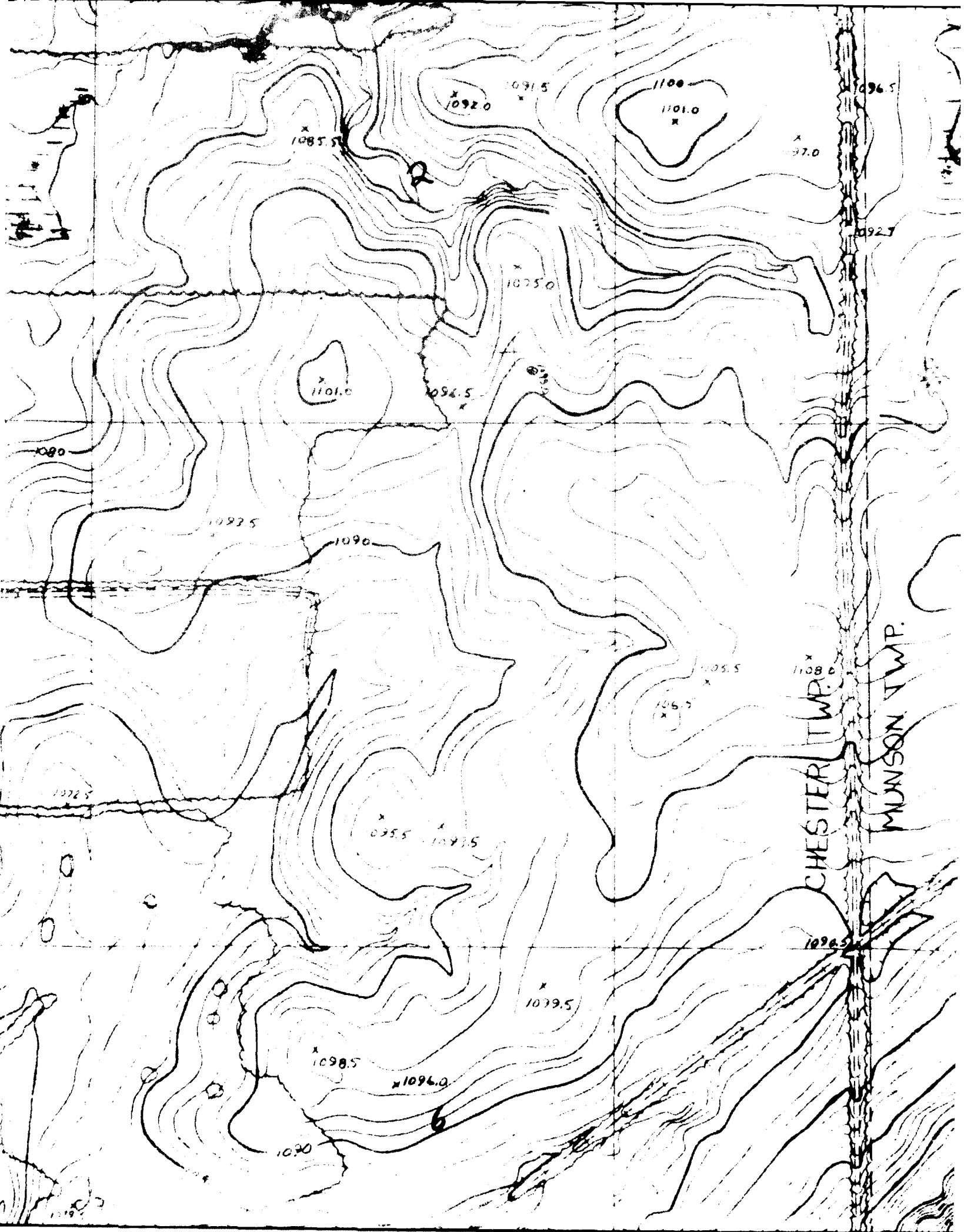
N 673,000

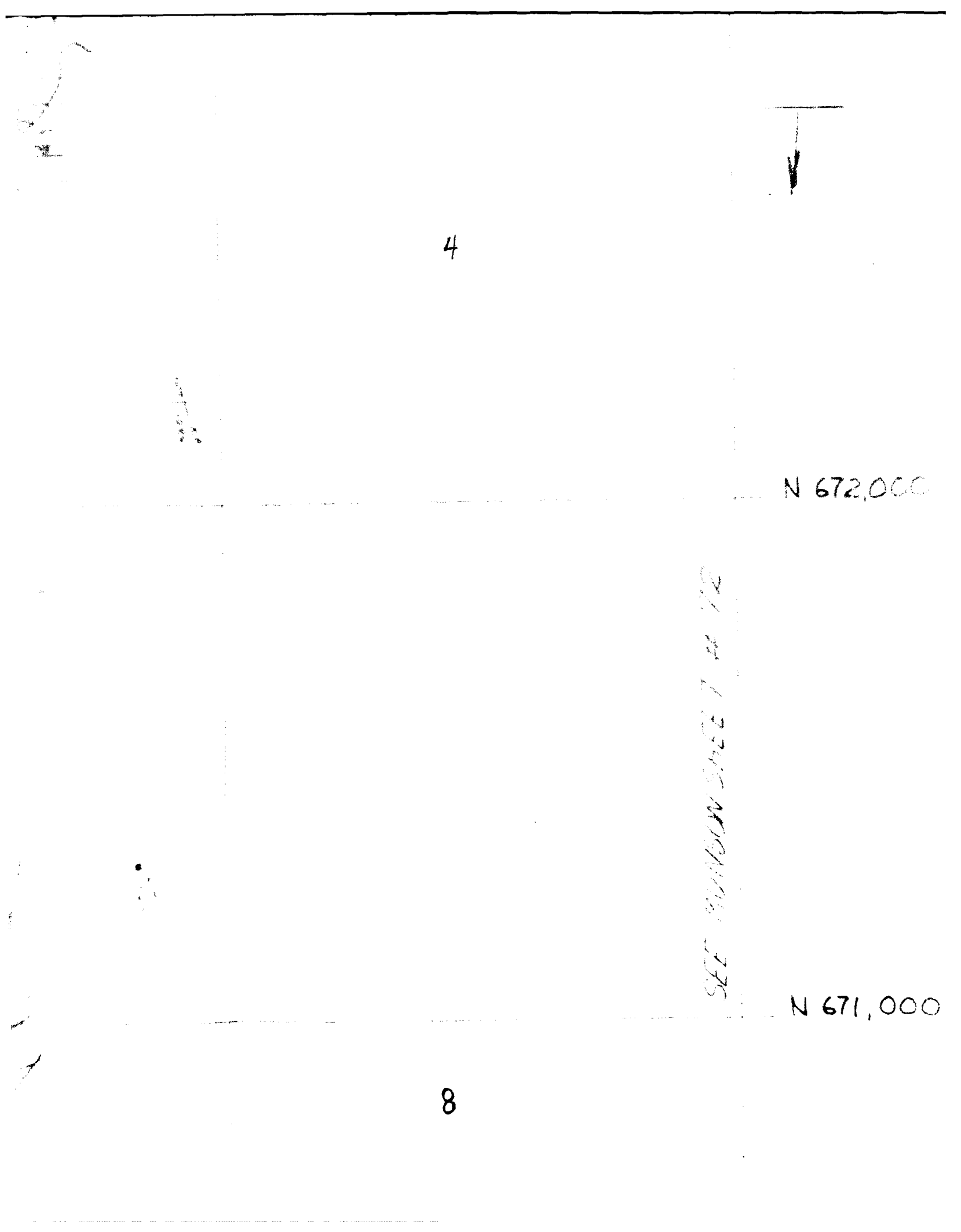
N

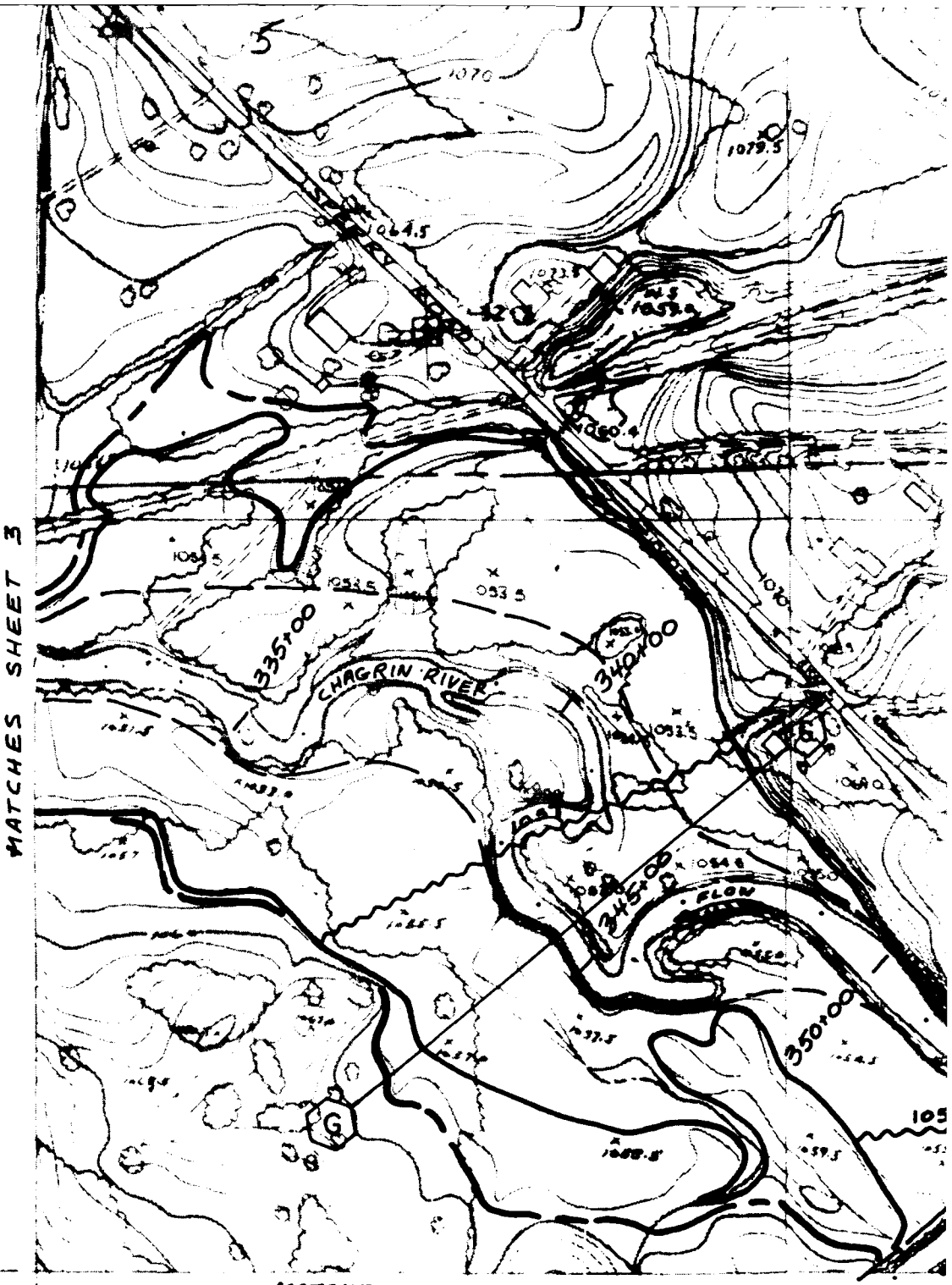
N 672,000

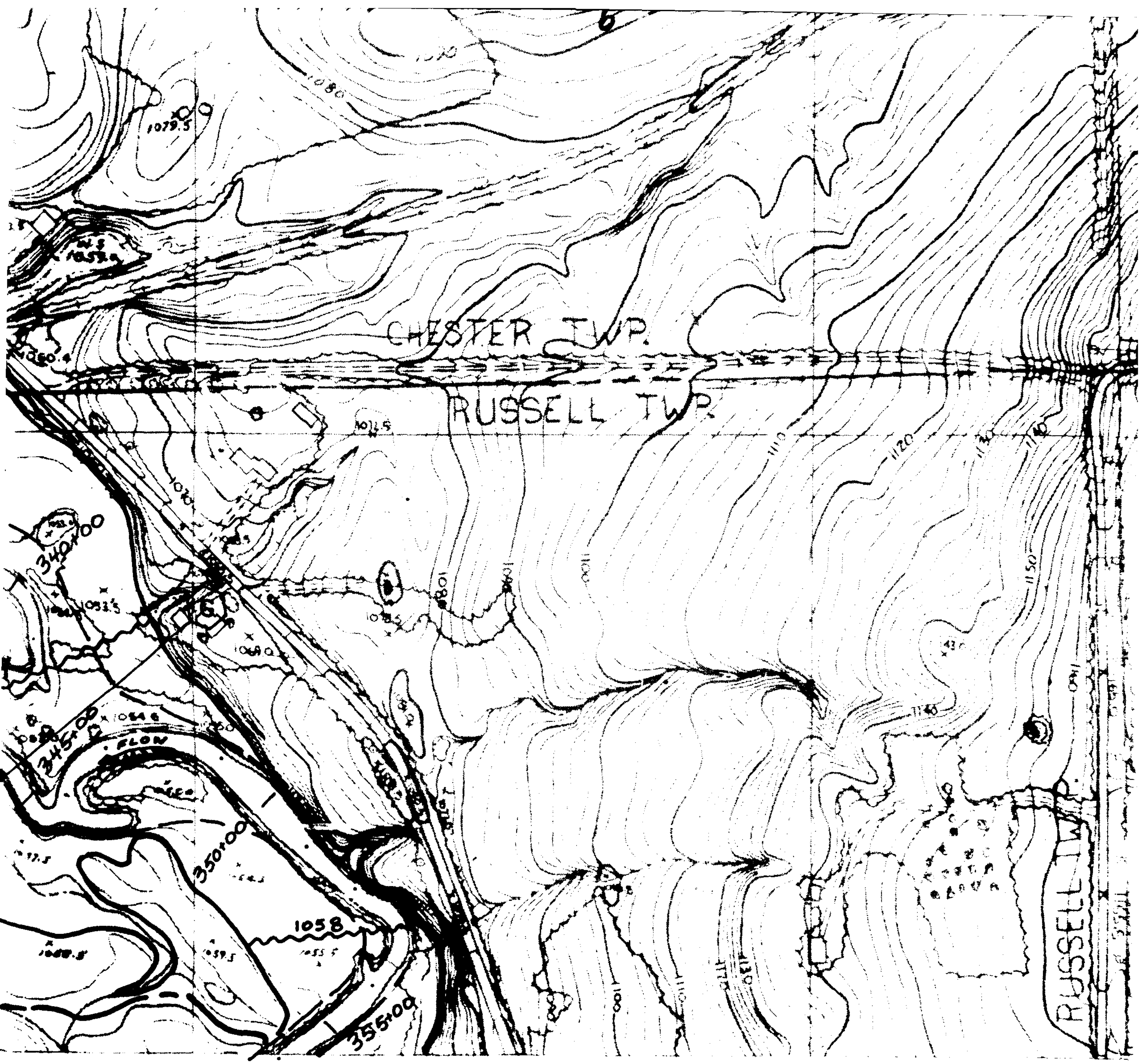
N 671,000




1092.0
1091.5
1100
1101.0
1096.5
1085.5
1097.0
1092.7
1075.0
1101.0
1096.5
1080
1092.5
1090
1105.5
1108.0
1106.5
CHESTER TWP.
MUNSON TWP.
1092.5
1095.5
1099.5
1098.5
1096.0
1090


4
N 672,000
N 671,000
8


N 670,000
MATCHES SHEET 3
335+00
CHAGRIN RIVER
340+00
345+00
FLOW
350+00
MATCHES SHEET 5
N 669,000
E 327,000
E 328,000
RM-



LEGEND

— — — —	500-YEAR FLOOD PLAIN BOUNDARY
————	100-YEAR FLOOD PLAIN BOUNDARY
— — — —	FLOODWAY LIMITS
⬡———⬡	CROSS SECTION LOCATION
~~1030~~	BASE FLOOD ELEVATION
RM-1 X	ELEVATION REFERENCE MARK

E 328,000

E 329,000

DISTANCE IS M
DOWNSTREAM

SCA
1 INCH =

INDEX TO SHEETS

	3	4
1	2	5

DISTANCE IS MEASURED IN FEET FROM 2400 FEET DOWNSTREAM OF KINSMAN ROAD.

E 330,000

SCALE
1 INCH = 200 FEET

N 670,000

N 669,000

E 331,000

E 332,000

SHEETS

U. S. Army Engineer District, Buffalo

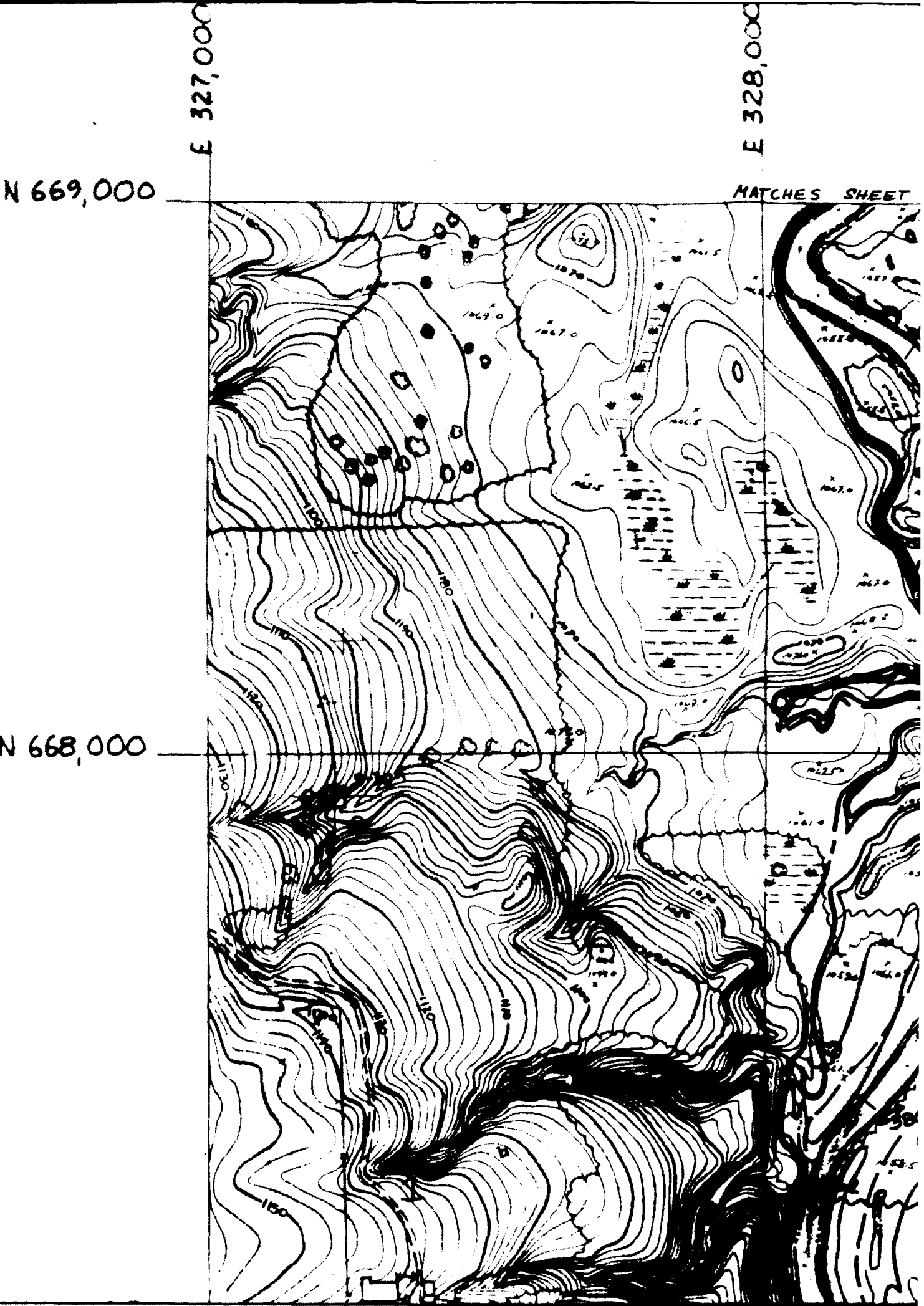
SPECIAL FLOOD HAZARD EVALUATION

FLOODED AREA MAP

CHAGRIN RIVER

GEAUGA COUNTY, OHIO

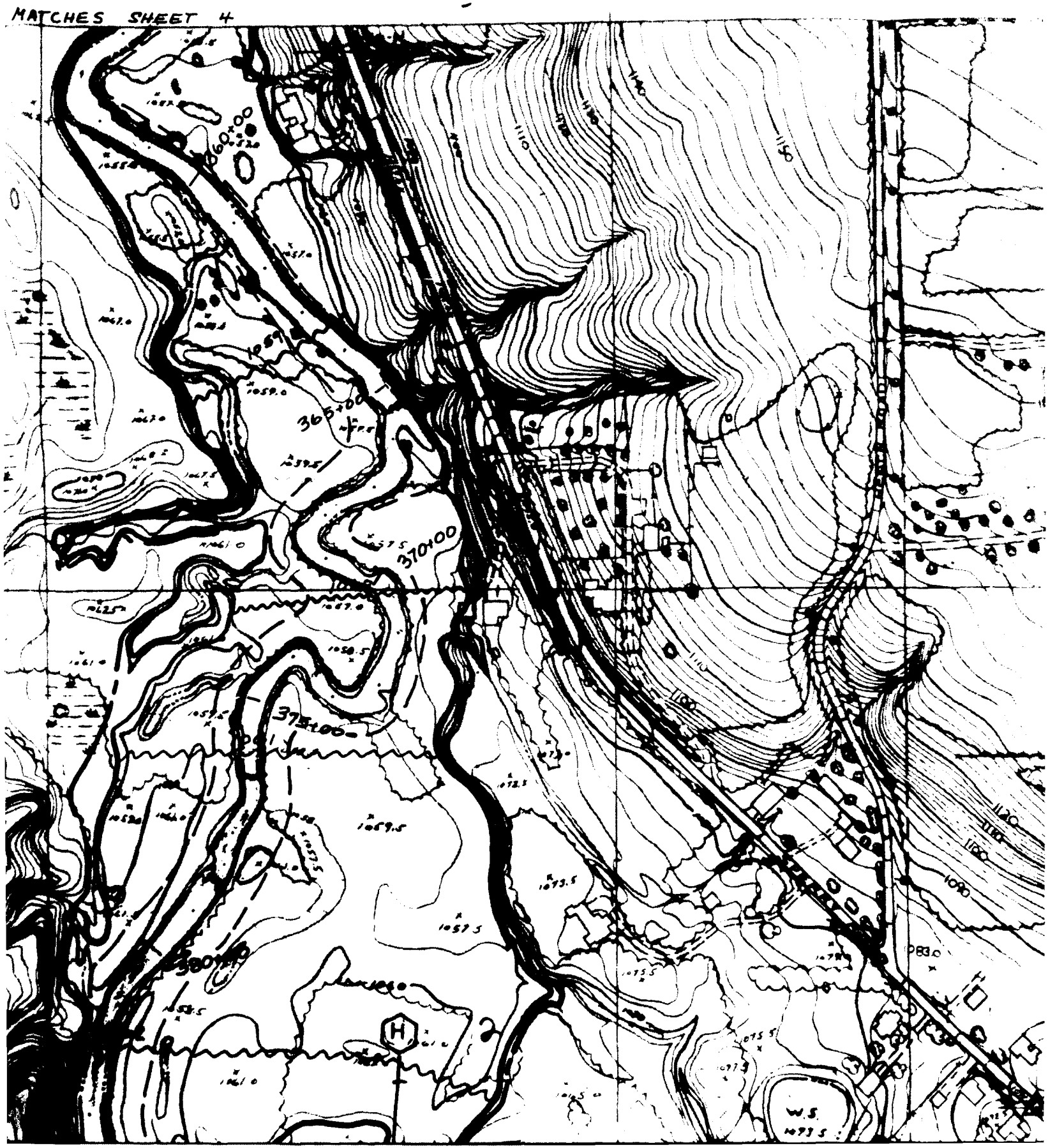
SHEET 4 OF 5 SEPT. 1992

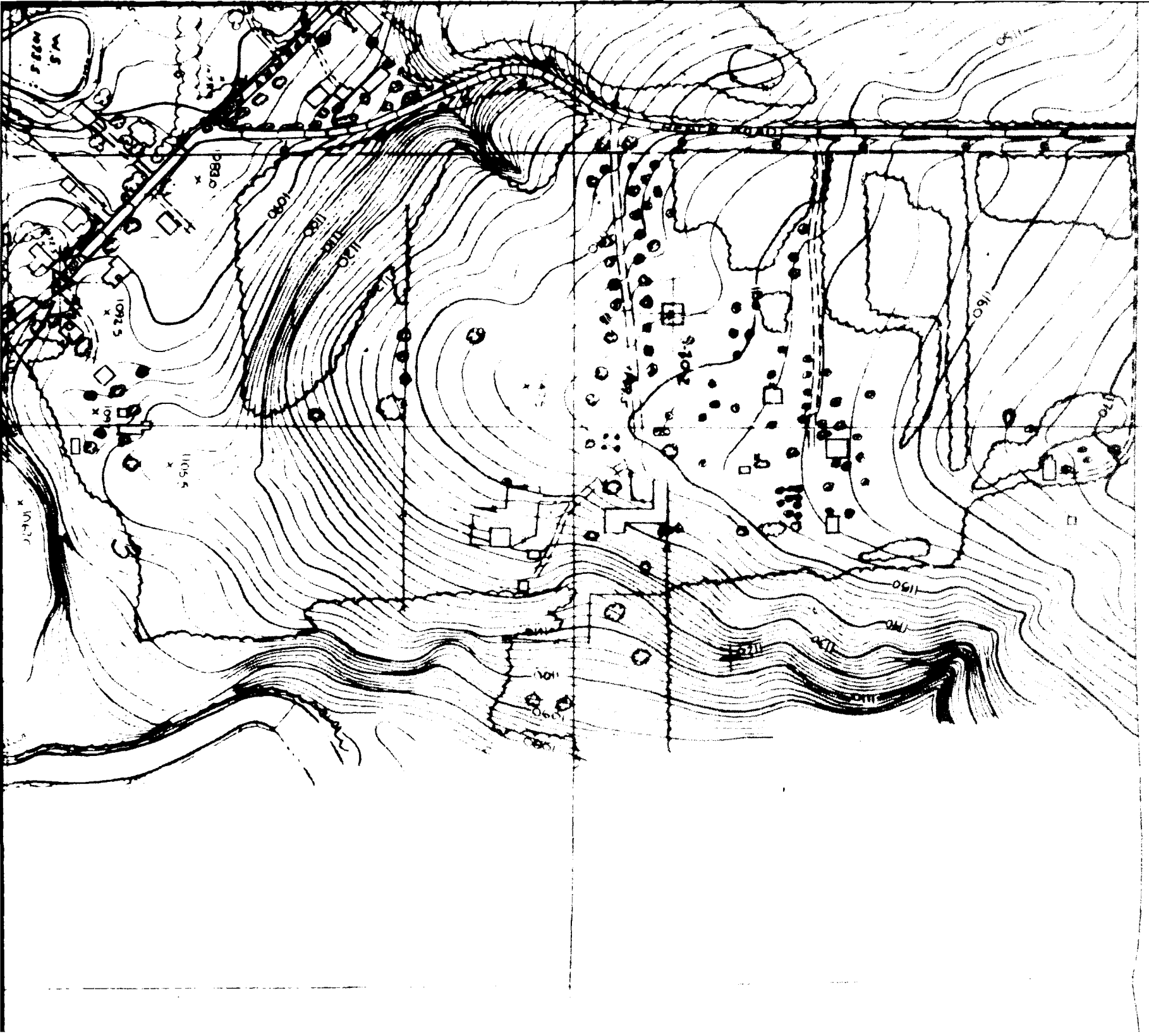

E 327,000
E 328,000
N 669,000
N 668,000
MATCHES SHEET

E 328,000

E 329,000

MATCHES SHEET 4





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E 331,000

E 332,000

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N 669,000

N 668,000

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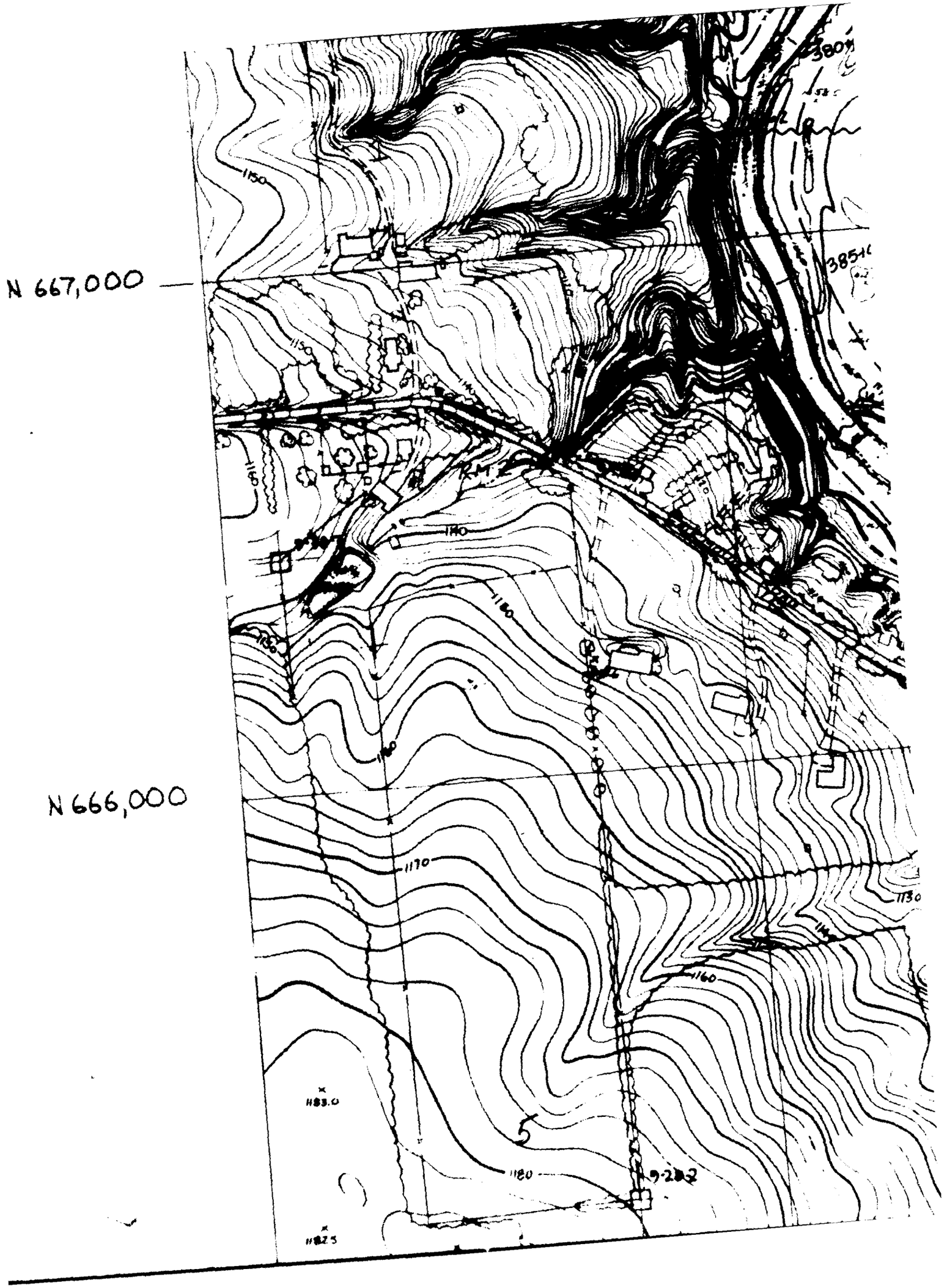
N 667,000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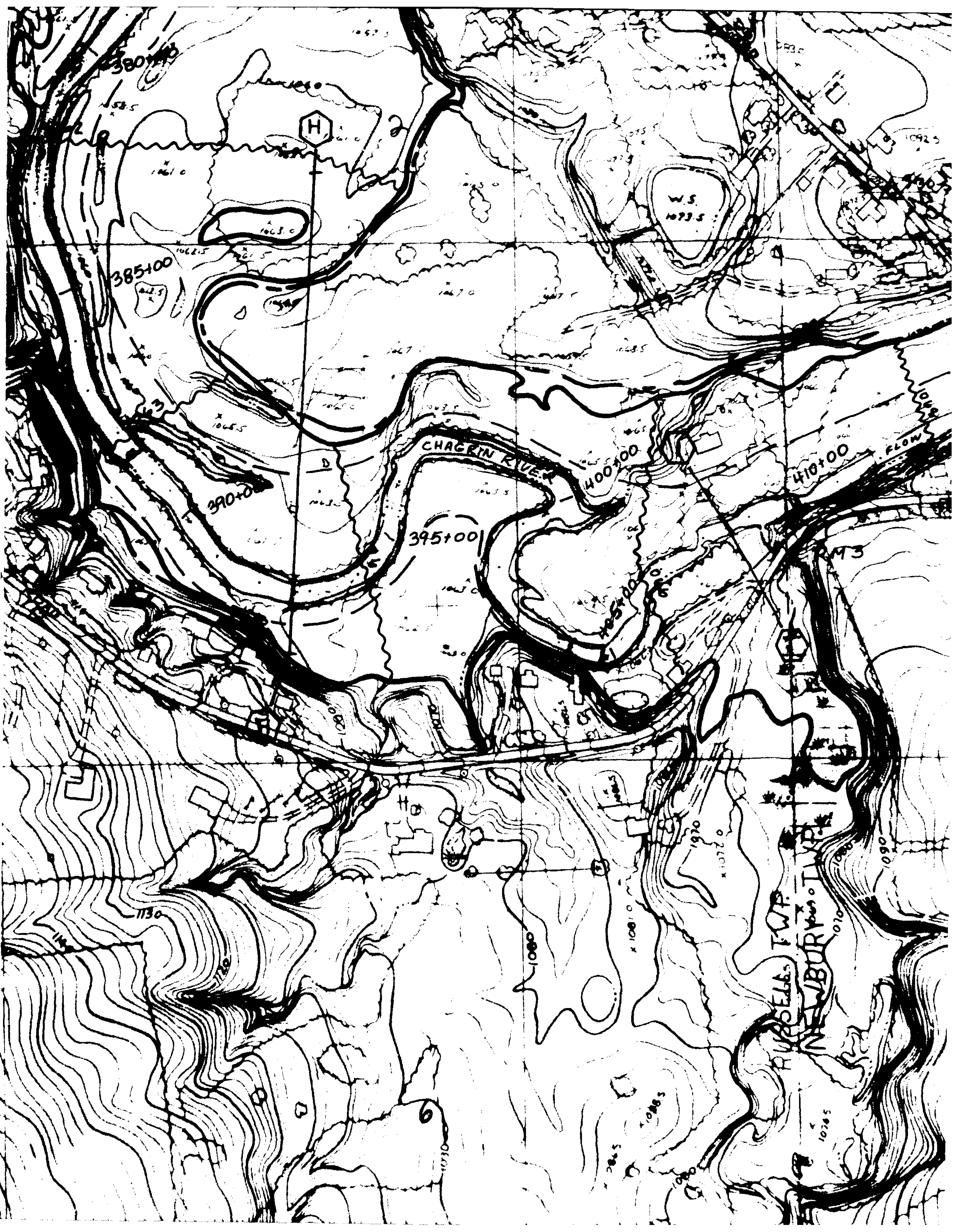

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385+00
390+00
395+00
400+00
405+00
410+00
CHAGRIN RIVER
FLOW
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1130
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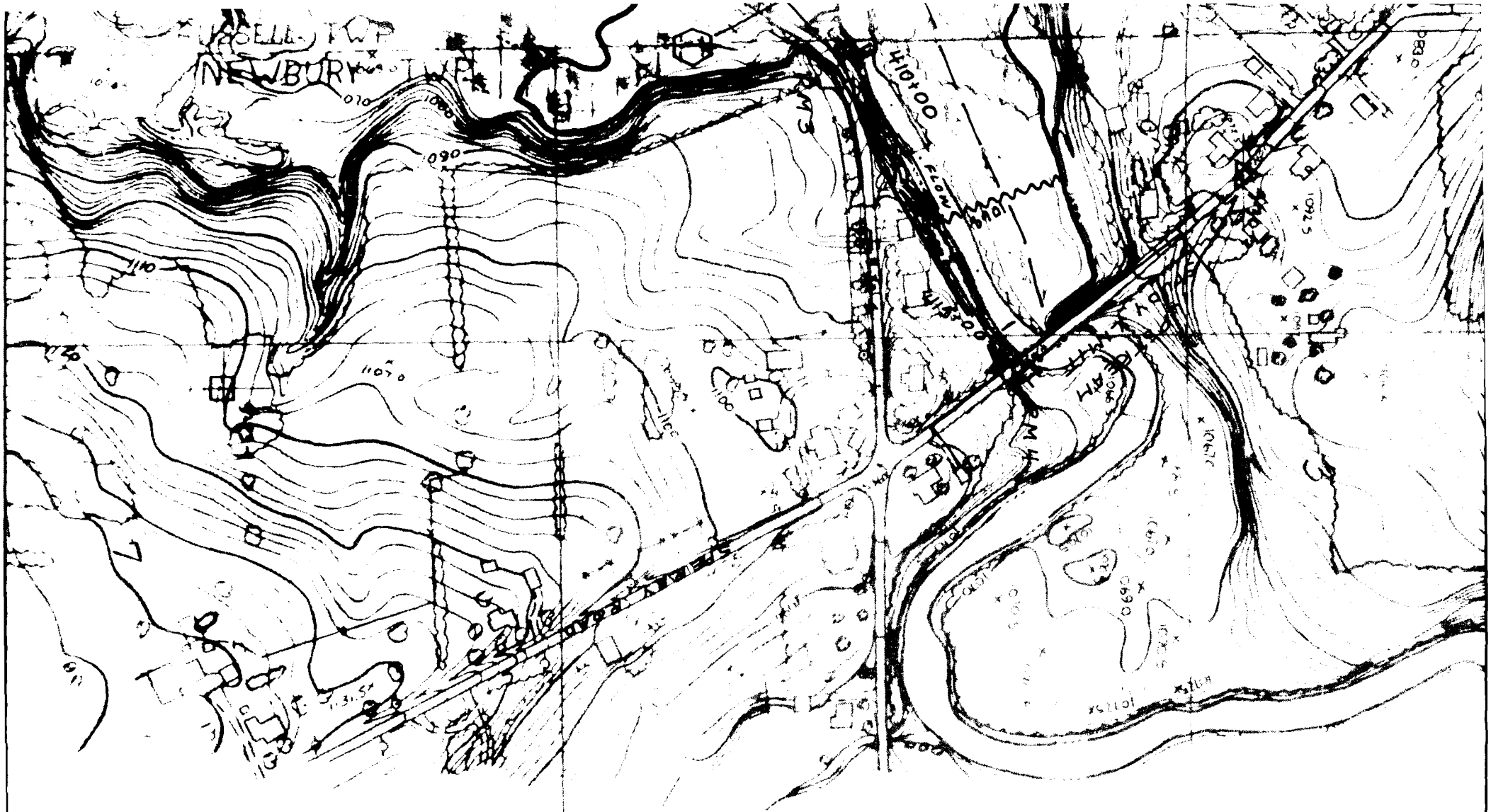
RUSSELL TWP.
NEWBURY TWP.
6


NEWBURY
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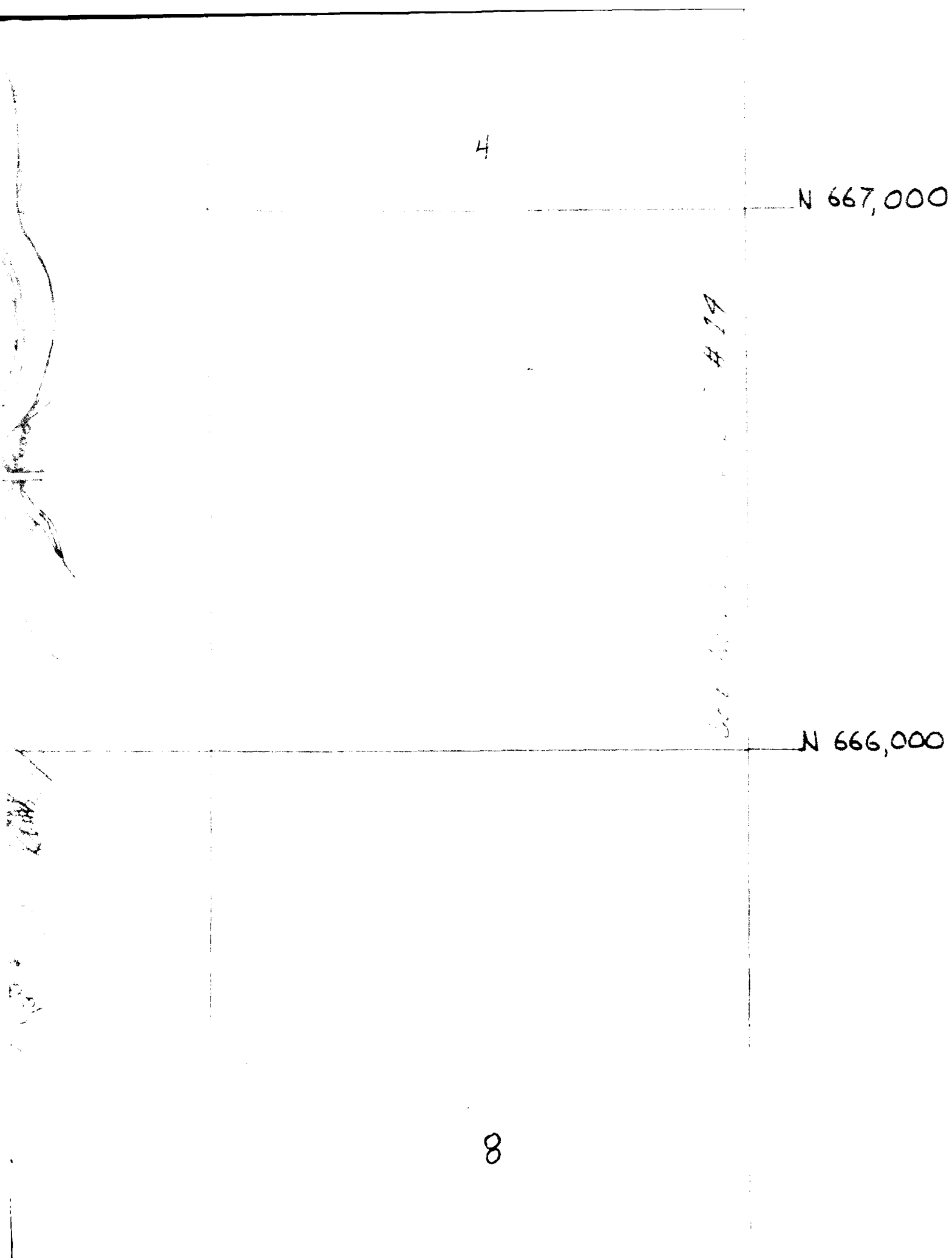
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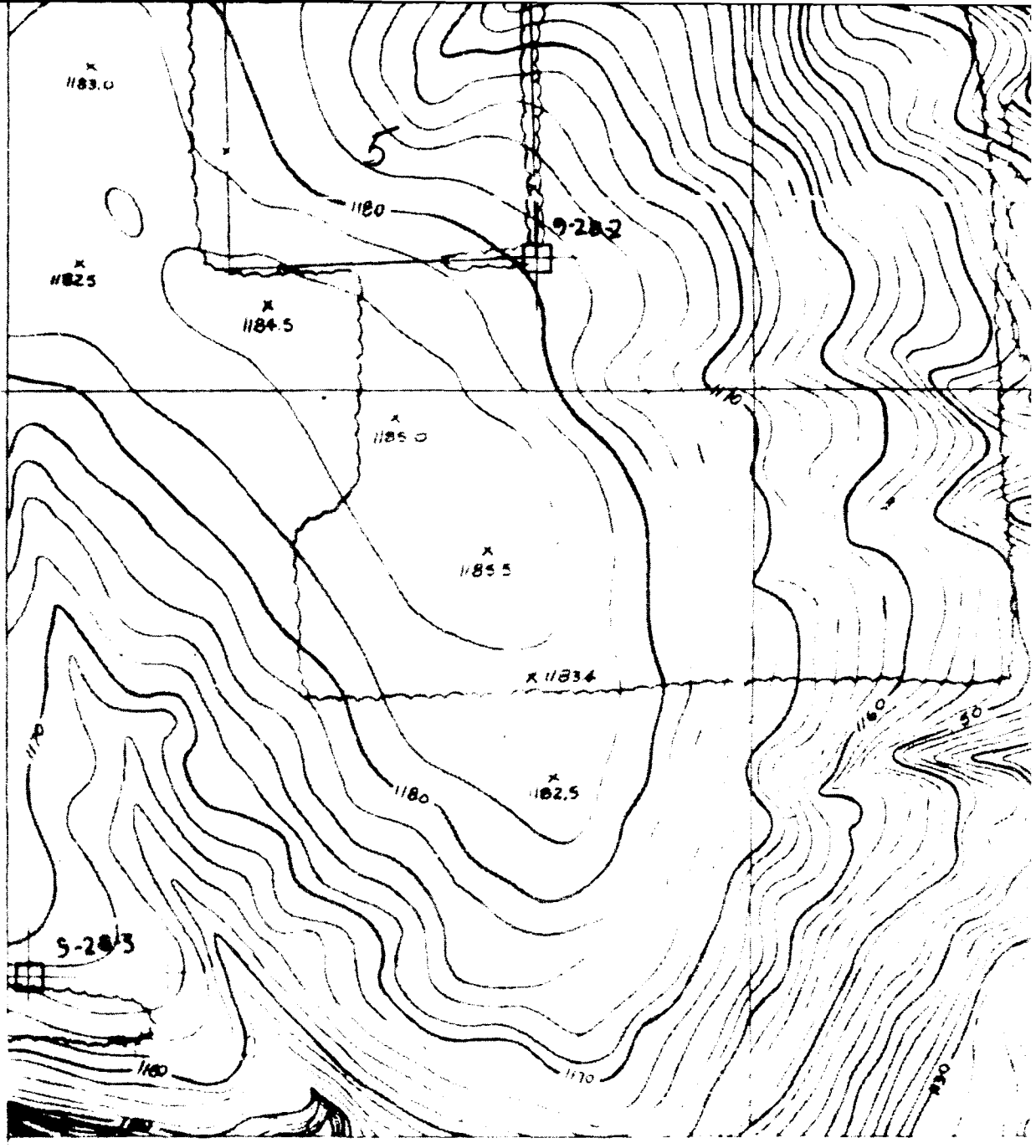
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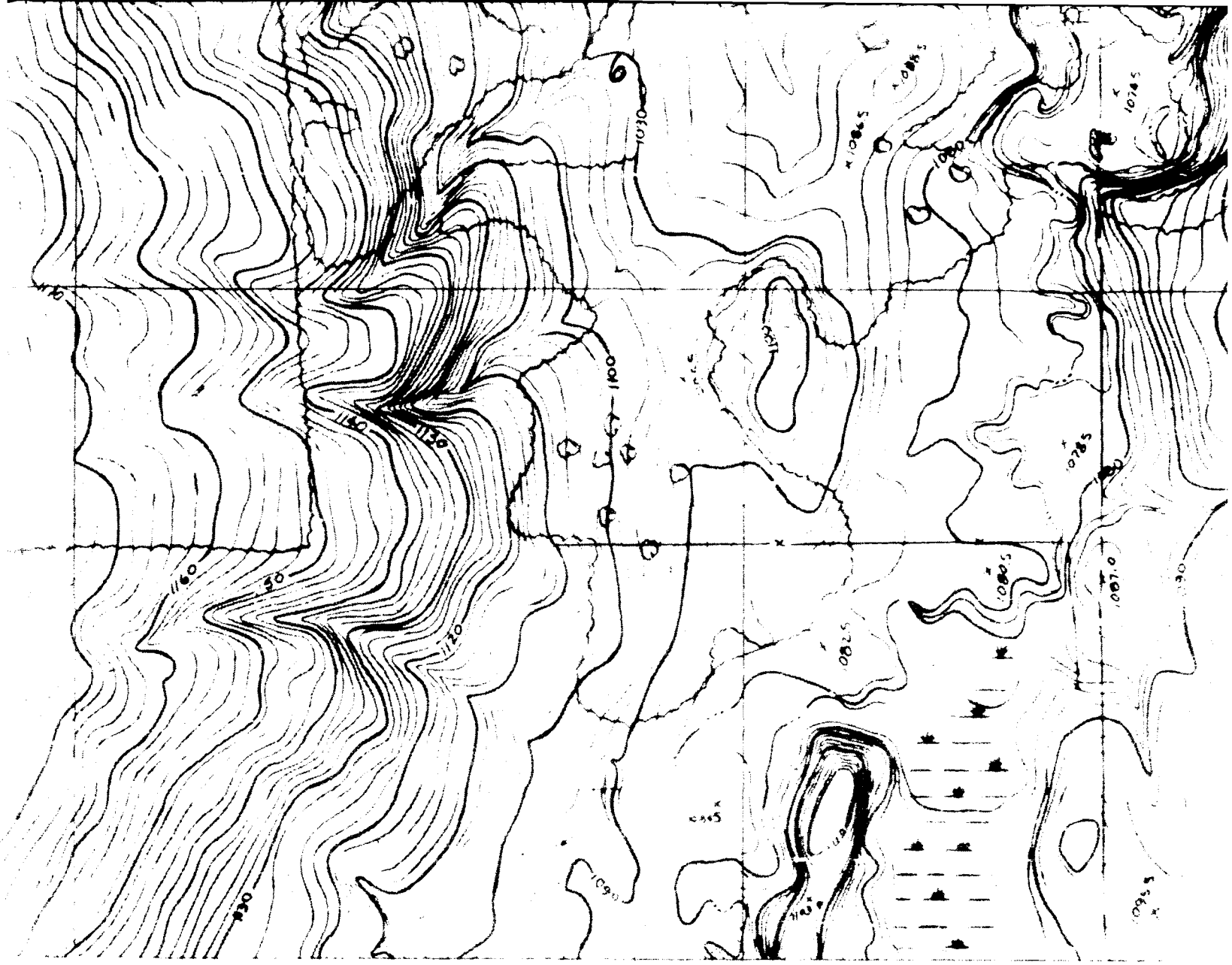

LEGEND

500-YEAR FLOOD PLAIN BOUNDARY

100-YEAR FLOOD PLAIN BOUNDARY

FLOODWAY LIMITS

CROSS SECTION LOCATION

1020 BASE FLOOD ELEVATION

RM-1 X ELEVATION REFERENCE MARK

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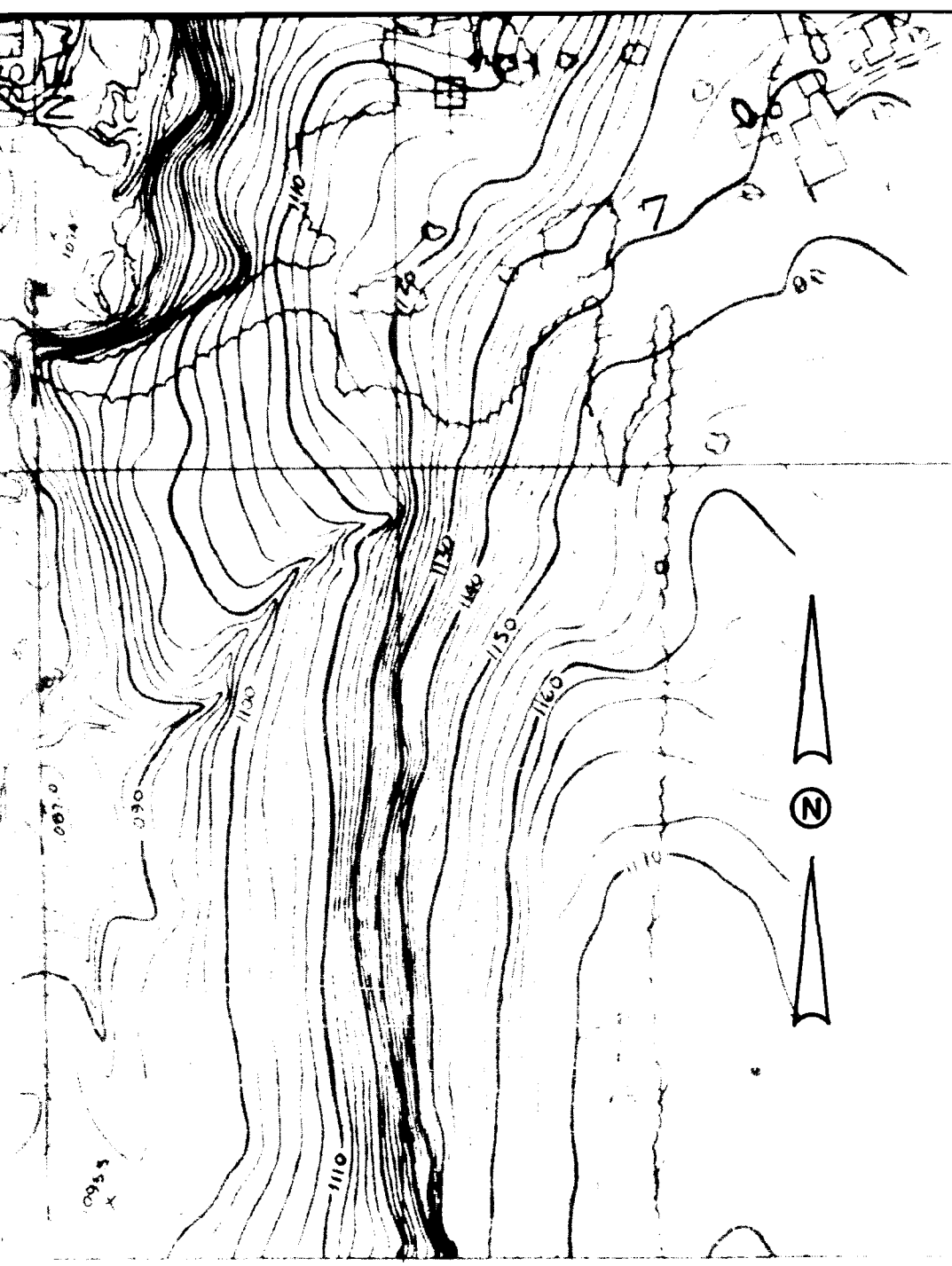
329,000

DISTANCE IS MEASURE
DOWNSTREAM OF KI

SCALE
1 INCH = 200 FE



INDEX TO SHEETS

	3	4
1	2	(5)

E IS MEASURED IN FEET FROM 2400 FEET
REAM OF KINSMAN ROAD.

SCALE
INCH = 200 FEET

E 330,000

E 331,000

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N 664,000

SHEETS

4
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E 331,000

U. S. Army Engineer District, Buffalo

SPECIAL FLOOD HAZARD EVALUATION

FLOODED AREA MAP

CHAGRIN RIVER

GEAUGA COUNTY, OHIO

SHEET 5 OF 5 SEPT. 1992

E 332,000